UNIVERSALITY AND NETWORK EVOLUTION: THE CASES OF KOREA INFORMATION INFRASTRUCTURE AND CDMA (CODE DIVISION MULTIPLE ACCESS) DEVELOPMENT

Min-Jeong Kang

PhD

The University of Edinburgh

1998

DECLARATION

I hereby declare that this thesis was composed by myself and that the work is my own.

Min-Jeong Kang

ABSTRACT

This thesis focuses on the case of the Korean telecommunications industry, by examining the changes in the market and in technology development systems in general, and, in particular, the cases of the Korea Information Infrastructure (KII) programme and a digital mobile communications system development, Code Division Multiple Access (CDMA). KII and CDMA are being developed against the back cloth of the restructuring of the telecommunications industry. The changes and challenges of network evolution in the 1990s demonstrate how the restructuring is being conducted under open market pressure and internal demands from the private sector. The challenges are emerging in an institutional rationale of protectionism both in telecommunications policy and in the national R&D system.

This thesis combines the 'social shaping of technology' tradition in technology studies and the political economy of telecommunications, with empirical evidence from a newly industrialising country, recognising telecommunications as a complex of technology and social institutions. The main research question is how political and economic interests are embedded in the process of introducing and developing new services in network evolution.

The cases of KII and CDMA exemplify the changes in, and challenges of, telecommunications, reflecting a particular set of social relations in Korea. KII, a national initiative of network design, entails the dilemma between Social Overhead Capital and highly profitable industry in the nature of telecommunications. The design process, although it did not take much time to implement, already embodies interests of industrial capital and Korea Telecom in realigning technological tasks and policy direction. The CDMA case shows more explicitly how the national R&D system is being fragmented, reflecting the power of industrial capital under heavy market pressure.

The findings of this thesis show that the changing order of telecommunications is subject to social shaping, in a way which reflects the political and economic interests of players. In the specific social context of the NICs, globalisation contrasts with developmental concerns. Globalisation, developmental concerns and a particular set of social relations are embedded in network evolution, which are operating within an authoritarian mechanism.

Based on the findings of this process oriented research, the technological and political concerns to build public interests in network construction is suggested, reflecting on what the purpose the network is to be. Network evolution is a design process which can enable us to assess different sets of network functions and service applications. This is also a political question of how social agencies are participating in the design process. Universal service should be concerned with the network design process rather than being restricted to financial considerations.

ACKNOWLEGEMENTS

My first and deepest gratitude goes to my supervisors, Dr. Alfonso Molina and Dr. Wendy Faulkner, for their kind encouragement and advice. Their sincere and productive guidance have held me on course in conducting this research.

Si-yeon, Hye-won, Simone, Donald, Alex, Mark, Derek, Xiobai, Ca, Lez, James and Robert are my dear friends who have supported me with warm and cheering friendship in Scotland. With them and this country, I have found understanding, humour and warm-heartedness, despite the harsh wind over the seasons I have got through.

Special thanks to Ju-Hyung Lee in SK Telecom and Tae-Chul Jung in DACOM for their kind advice and help during my fieldwork as well as during my working days in KISDI. This study was made possible through the co-operation of staff from the organisations I visited. I am grateful to the people who gave their precious time, views and information to a nameless student, during my fieldwork period in Seoul. I am especially grateful to Tae-Sup Yoon of the National Computerisation Agency, Hong-Soon Yim of Korea Telecom, Hyung-Man Kim of Korea Telecom Trade Union, Kwang-Ho Kim of the Electronics and Telecommunications Research Institute, Kyo-Young Kim of the Ministry of Information and Communications, Chul-Kyu Kim of *Hyundai* Electronics, and Soon-Ho Hong of *Samsung* Electronics.

My deep thanks to the people I left behind in my own country, my sister Min-Suk, my mother and father, my dear friend Ju-Hee, my comrades in the KISDI Union, and Byung-Keun Kim - President of the Union as well as my friend, for their trust and love which has given me the courage and energy to keep up my work and live my life.

This research was supported by the Overseas Research Student Scheme and the British Council. I am grateful for their support of, and belief in my research.

CONTENTS

PART TWO: LITERATURE REVIEW ON THE TRANSITION IN TELECOMMUNICATIONS

PART THREE: THE EMPIRICAL CASE STUDY OF KOREAN TELECOMMUNICATIONS

PART FOUR: ANALYSIS AND CONCLUSIONS

CHAPTER 12: THE SOCIAL SHAPING OF TELECOMMUNICATIONS

LIST OF FIGURES AND TABLES

FIGURES

TABLES

LIST OF APPENDICES

ACRONYMS AND ABBREVIATIONS

ALPs	Alternative Local Providers
AMPS	Advanced Mobile Phone Service
APEC	Asia-Pacific Economic Community
ASIC	Application Specific Integrated Circuit
ATM	Asynchronous Transfer Mode
AT&T	American Telegraph & Telephone Company, United States
BBCC	The Association for Broad-band Business Chance and Culture Creation, Japan
B-ISDN	Broad-Band Integrated Services Digital Network
BOCs	Bell Operating Companies, United States
BSC	Base Station Controller
BTS	Base Transceiver Station
CAPs	Competitive Access Providers
CCITT	Consultative Committee for International Telegraph and Telephone
CDMA	Code Division Multiple Access
CMS	CDMA Mobile System
DM	Design Model
EMD	Electro-Mechanical Division
ETRI	Electronics and Telecommunications Research Institute, Korea
FCC	Federal Communications Commission, United States
FDMA	Frequency Division Multiple Access
FPLMTS	Future Public Land Mobile Telecommunications System
FTTC	Fibre To The Curb
FTTH	Fibre To The Home
FTTO	Fibre To The Office
GATT	General Agreement on Tariffs and Trade
GII	Global Information Infrastructure

GSM	Global System for Mobile Communications
HLR	Home Location Register
IBSN	Integrated Broad-band Communications Network
IN	Intelligent Network
ISDN	Integrated Services Digital Network
IT	Information Technologies
ITU	International Telecommunications Union
KII	Korea Information Infrastructure
KMT	Korea Mobile Telecom (Former SK Telecom), Korea
KMTC	Korea Mobile Telecom Co. (Former Korea Mobile Telecom), Korea
KT	Korea Telecom, Korea
LECs	Local Exchange Companies
MFJ	Modified Final Judgement, the United States
MOC	Ministry of Communications (Former MIC), Korea
MIC	Ministry of Information and Communications (since 1995), Korea
MNCs	Multi-National Companies
MPT	Ministry of Post and Telecommunications, Japan
MS	Mobile Station
MSC	Mobile Switching Centre
NAFTA	North America Free Trade Agreement
NCA	National Computerisation Agency, Korea
NGBT	Negotiation Group on Basic Telecommunications
NICs	Newly Industrialising Countries
NII	National Information Infrastructure, the United States
N-ISDN	Narrow-band Integrated Services Digital Network
NREN	National Research and Education Network, United States
OECD	Organisation for Economic Co-operation and Development
OFTEL	Office of Telecommunications, United Kingdom
ONP	Open Network Premises
PCN	Personal Communications Network

PCS	Personal Communications Services
PSTN	Public Switched Telecommunications Network
PTOs	Public Telecommunications Operators
R&D	Research and Development
RTS	Radio Transmission System
RBOCs	Regional Bell Operating Companies, the United States
RF	Radio Frequency
SOC	Social Overhead Capital
SST	Social Shaping of Technology
TDMA	Time Division Multiple Access
TDX	Time Division Exchange
TNCs	Trans-National Companies
TOs	Telecommunications Operators
TRS	Trunked Radio Services
UMTS	Universal Mobile Telecommunications System
USO	Universal Service Obligation
UPT	Universal Personal Telecommunications
VAN	Value Added Network
VLR	Visitor Location Register
VPN	Virtual Private Network
WIPO	World Intellectual Property Organisation
WTO	World Trade Organisation

PART I

INTRODUCTION AND RESEARCH METHOD

Chapter 1: Introduction

1.1 Background

To speak of a transition in telecommunications today has become a cliché as it conveys notions about the 'information society'. I found the cliché becoming even more pervasive since starting this research. The transition, truly, is being constructed quickly and is disputed thoroughly in the divergent aspects of information and communication technologies. Telecommunications is simultaneously an objective of the transition and a facility for it. "Advanced information and communication technologies are especially complex because they are both machines and media. As such they are both the objects and facilitators of consumption" (Mansell and Silverstone, 1996: 9). Technologies, new service alternatives and the policy issues surrounding telecommunications are far reaching and diverse.

Discourses surrounding the transition often entail assumptions that technology per se is neutral rather than being shaped by social relations. Unveiling the common belief that technology is neutral, we encounter the ideology of progress. But what is progress and who decides its direction? There is no universal principle of progress, rather, there are only directions which the members of society envisage. Visions and perspectives on the future are diverse (Miles, 1996), and this diversification is, in fact, shaping the 'information society', reflecting the characteristics of the social structure. Awareness of the social shaping of technology unveils the process in which social and technical elements are involved in the development and use of technology.

Technological change is commonly perceived as bringing about transitions in society. However, social transition takes place through the conflicts which hegemonic interests of social groups create in the process of sustaining and changing the existing order. Social groups are often seen as free from value when their interests are embedded in 'technology'. But technology reflects the way in which society demands and adopts it. The advent of an information society still depends on the availability of technology and on its access

(Mansell and Silverstone, 1996: 223). If the technology available is claimed to be 'progressive', the questions for whom, and for what, the technology is being developed and implemented, still remain.

It can even be said that technology creates a new order and a logic in the process of the reproduction of its development and deployment. It might be more correct to say that the forces adopting the technology do so. Opportunities that arise from the nature of the technology per se, and choices that arise from the way the technology is adopted, are often blurred. The choice reflects the logic of the characteristics of society and the logic of the social organisations which differs from one society to another. If we admit that the choice per se embraces social dynamics, it is worthwhile to look at the process of choice and decision in its particular social context.

Telecommunications is not a simple artefact but a set of various technologies and social institutions: "telecommunication networks are themselves a representation of social, economic and political organisational and information networks which exist in the public and private sphere" (Mansell and Jenkins, 1992: 33). Telecommunications that started from the telegraph service and settled in telephony has been diversified and consecutively merged, combined and separated in terms of network features. Technologies that stem from diversified fields now constitute telecommunications services and institutions, reflecting the interests of social agencies such as regulators, Public Telecommunications Operators (PTOs) and user groups.

New technologies, together with institutional changes, have been built and deployed bringing about a telecommunications network evolution with enhanced services and network functions such as digitalisation and the intelligent network. The telecommunications industry is being restructured from a former public service to one which faces the introduction of competition and the privatisation of PTOs. Globalisation, which economic and political systems are adopting as a new rationale, encourages the development of a telecommunications network in which the national telecommunications network is expanding to become a globalised network.

This new order started from the restructuring of telecommunications in the United States, beginning with the divestiture of AT&T in 1984 and followed by a series of market liberalisation policies. The series of policies has now arrived at the introduction of full competition in the newly established Telecommunications Act in 1996 in the USA. The restructuring of telecommunications in the USA has been influencing changes all over the world in the form of open market pressure which is also taking place in other areas of services and goods trades.

The restructuring of telecommunications reflects the way in which countries resolve the challenges they are faced with internally and externally. In particular, since restructuring occurs under open market pressure in the context of globalisation, the interests and the positions in dealing with the restructuring differ from one country to another, depending on their status in the hierarchy of the international division of labour. Newly Industrialising Countries (NICs) like Korea face challenges as a result of open market pressure, and these challenges are interacting with the internal social structure of power relations. The shaping process of telecommunications - as with other technologies - embodies the problems and concerns of the particular social contexts in which it occurs.

In the middle of this restructuring, questions of public interests and the way to meet them in telecommunications are being reinterpreted and reconsidered. The concerns of public interests and improving national telecommunications infrastructure are often blurred in the process of restructuring. This is mainly because the restructuring is carried out in accordance with the discourses of national competitiveness, globalisation and liberalisation. Public interests in telecommunications need to be defined and achieved, addressing specific concerns which are differentiated from national competitiveness. How national competitiveness is correlated with public interests in telecommunications is not a main concern in the restructuring, and it is overlooked by the general assumption that national competitiveness will increase the wealth of the nation.

The main focus of my research is on how the transition in telecommunications is taking place alongside its social contexts; and, by doing so, this research suggests how public interests can be realised in the transition.

1.2 Main Analytical Concepts and Framework of Thesis

This section introduces the main analytical concepts and framework used in this thesis in understanding how the transition taking place in telecommunications and in accommodating case studies. The areas covered are a consideration of the sociotechnical approach; sociotechnical constituencies and governance; political economy perspectives; the concept of the developmental state and civil society in NICs; the authoritarian mechanism; Telecommunications Network-base Services (TNS) and a 'strategic model'; and the transition of telecommunications.

1.2.1 Sociotechnical Approach

The premise of the research is that the technical innovations, which constitute network evolution and the technical elements of telecommunications are neither fixed nor preordained to move in a certain direction. Rather, network design largely resides within the political and economic environment, in which the strategic activities from emerging large users, existing residential and small and medium sized users, existing PTOs and public organisations are involved, and which are constituted by a particular constellation of political intentions and economic needs in each country. Identifying the actors and rules behind the transition is the first step towards analysing the process by which a new order is built. The basic analytical position of the research lies in the tradition of the social shaping of technology (SST) body of knowledge since technology studies in this stream shed light on the underlying political, economic and other social forces shaping the development and implementation of technology policies.

The social shaping of technology perspective possesses its own interdisciplinary methodology based on the characteristics of technology, recognising it as a unique entity. The 'sociotechnical' approach is part of this tradition, seeking a methodology appropriate to the characteristics of technology, and it has evolved in a process of self-reflection and responses to criticism.

In the early 1980s, social constructivist scholars suggested that technology should be dealt with as a form of social construction; they argued that the 'social' and the 'technical' do not exist in a dichotomy, and the task of technology studies should be to seek a dialectic departure, departing from this dichotomy. The constructivist approach started to look at technology development as a 'sociotechnical' process. It was based on the criticism that the existing research on the sociology of technology was largely a descriptive historiography and had an asymmetric focus on the analysis (Pinch & Bijker, 1987). In the social construction of technology (SCOT) model, "the developmental process of a technological artefact is described as an alternation of variation and selection" (Pinch & Bijker, 1987: 28). The interactions within 'relevant social groups' shape artefacts. The idea of 'interpretative flexibility' finds its philosophical and methodological basis in the principle of symmetry. Sociologists reveal the process of interaction and the meaning of the artefacts for each group, focusing on the problems and associated solutions that relevant social groups present about the artefacts until 'closure'. Eventually, sociologists succeed in revealing that a certain artefact is constructed socially, to be exact, through the social interactions of relevant social groups.

Alongside the SCOT model, research on large systems such as electric systems is found in the Hughes' sociotechnical system model (Hughes, 1983). His analysis starts from the recognition that "technological affairs contain a rich texture of technical matters, scientific laws, economic principles, political forces, and social concerns" (Hughes, 1983: 1). He also stresses the internal dynamics of a developing technological system, arguing that "because they are invented and developed by system builders and their associates, the components of technological systems are socially constructed artefacts" (Hughes, 1987: 52). His main analytical framework, the 'system', is rather equivocal. The 'system' refers to a technical system, and also sometimes to a system which is interacting with components, some of which are not technical. The 'system' means "interacting components of different kinds, such as the technical and the institutional as well as different values; such a system is neither centrally controlled nor directed towards a clearly defined goal" (Hughes, 1983: 6). Hughes' system model contributes to expanding our perspective on individual groups to a perspective based on networks in which each individual group is related to the others. The network is more than a simple sum of its parts, in that the network is formulated by dynamic processes within technological systems development. The network consists not only of personal actors but also of institutional sectors of society.

Law (1988) contributed to enlarging our understanding of the 'system'. In his analysis, 'system builders' are not considered the same as the social interests. The system builders are constituted in the course of interaction with other actors. "The art in building a sociotechnical system lies in the process of putting different kinds of elements together in a way that properly constitutes and mobilises them all" (Law, 1988: 66). Goals, scenarios, tactics for constitution, mobilisation, and juxtaposition, and the obduracy of materials are the features that determine the character of technological innovation. These contents are related to the technological, the scientific, the political, the economic and the social. For scholars utilising this actors-networks theory (Law and Callon, 1992; Callon et al, 1992; Latour et al, 1992), the concept of the 'sociotechnical' includes not simply each technical and social world, but certain integrated systems which the actors are related to, and produce, in the process of solving problems. It is actors - heterogeneous engineers - who shape the technology in the sociotechnical system. They contribute to the system model by conceptualising the roles of 'actors'.

The contributions of the above models in the sociotechnical approach seem to reside in encouraging exploration of the complexity of the set of relations and events surrounding a particular technological development. However, these traditions (apart from Hughes) are open to criticism in the sense that they generally adopt a micro level focus which can work to ignore the ideologies and institutions behind the participating actors. SCOT and successive models, like actors-networks frameworks, have been criticised for their methodological and practical implications (Williams & Russell, 1988; Winner, 1993). The inappropriateness of employing the methods of the sociology of scientific knowledge is pointed out by differentiating between science and technology. The structure and boundaries of communities, their internal and external orientations, the relationship between the production of knowledge and its material realisation in science and in technology are different.

The criticism is also related to the issue of the micro-macro dispute, recognising that those models' conceptual starting point is the actions of individuals and the interactions between them, focusing on observable behaviour (Williams & Russell, 1988: 8). Russell (1986) argues that the danger of ignoring social influence over actors resides in 'political neutrality': "demonstrating the possibility of alternative technologies for alternative goals, and opening up the process of technological development to sections of society denies access to it" (Russell, 1986: 333). Further, interpretative flexibility can legitimate existing patterns of control and deny the possibility of change. He suggests that the 'social groups' identified by the constructivist approach need to be considered as a part of a 'structured' and historical context because social groups, as related to technology, are constrained and influenced by certain social, economic, political and ideological entities. He argues that technology studies should "not only explain technological development, but also demonstrate possibilities of changing its course to suit different objectives" (Russell, 1986: 343).

Despite the criticism of political ambiguity, SCOT finds itself in the realm of political practice: "if a social-constructivist image of technological development is not built up, stressing the possibilities and the constraints of change and choice of technology, a large part of the public is bound to turn away and to let technology get out of control" (Bijker, 1993: 131). However, it seems that the theoretical limitations are inevitably connected to the practical limitations. The suggestion that the SCOT model could serve the public understanding of science and technology appears in what the scholars using this model think the sociotechnical approach should be. Unless the SCOT model resolves the limitation of its methodology, i.e. restricted to research on observable phenomena, it does not seem to provide a convincing argument. If scholars in this model stick to a micro methodology, there is no room to understand the state's and capitalist role in shaping technology or, further, to explore the possibilities for the democratic control of technology.

These practical issues are deeply related to the theoretical realm. In general, studies on macro structure, such as capital, state, class, etc., intrinsically have political concerns as we see in the Marxist tradition. Micro sociology, whose concerns are directed at understanding 'day to day' life and interpersonal or inter-group 'interaction', has frequently been suspected of lacking political utility. However, so far as technology studies are concerned, this dichotomy might be unproductive. If we do not concentrate on concrete phenomena, in other words, if we do not open the black box, how can we establish effective practical alternatives? Despite the usefulness of the macro approaches in the political realm, technology will still remain distant from social scientists unless they open the black box. MacKenzie puts this point beautifully, suggesting that it is valuable "if only on the minimal grounds that any political movement worth its salt should have its eyes open for unexpected opportunities and unexpected allies" (MacKenzie, 1988: 9).

The sociotechnical approach provides us with useful methods for analysing technological development even though it is still not free from the criticism represented by Russell's argument. This approach makes it possible to reveal the process of formulating a system of technological development, tracing the controversies and the meanings of actors who observably participate in shaping technology. This approach contributes to a perspective on how the technology is produced and consumed as a process. The key thing about the sociotechnical approach is that it sees neither society nor technology as reducible one into the other, but sees the dense interactions between them as seamless. The 'sociotechnical' approach is not complete. Rather, it still allows an open space for the theoretical and practical challenges to become apparent. My research is positioned in this open space, enriching the possibility of the exploring social dynamics embedded in the technology development process.

1.2.2 Sociotechnical Constituencies and 'Governance'

Molina (1993) seeks to establish a useful framework in the tradition of the sociotechnical approach. The concept of 'sociotechnical constituencies' is useful in that it highlights the interacting and changing features of each sphere (social and technical), rather than simply leaving social factors as independent determinants. The concept of 'sociotechnical constituencies' is defined as "dynamic ensembles of technical constituents (tools, machines, etc.) and social constituents (people and their values, interest groups, etc.), which interact and shape each other in the course of the creation, production and diffusion of specific technologies" (1993: 20). 'Sociotechnical constituencies' embrace the 'technical' as a positive factor which interacts with the 'social', resolving the common dichotomy between 'social' and 'technical' emphases.

What is important in the sociotechnical constituencies perspective is that it emphasises interrelation and interaction in technological development. In 'sociotechnical constituencies', both social and technological constituents merge into each other. In this respect, constituencies are similar to 'actors-networks', in that non-human and human constituents participate in the shaping process. In 'actors-networks', however, human and non-human actors share a similar status as 'actors'. This is not the case in 'constituencies', which also identify a more structural macro level of 'social constituents' in collectives such as the military, government, capital and science (Molina, 1988). These macro social constituents interplay in a complex of power that shapes the broad development of technology within a social structure that tends to reproduce the power base of the dominant social constituency. The important point of the concept is that in sociotechnical constituencies, at all levels, only the social constituent parts are the creators, or 'purposive' drivers, in technological development.

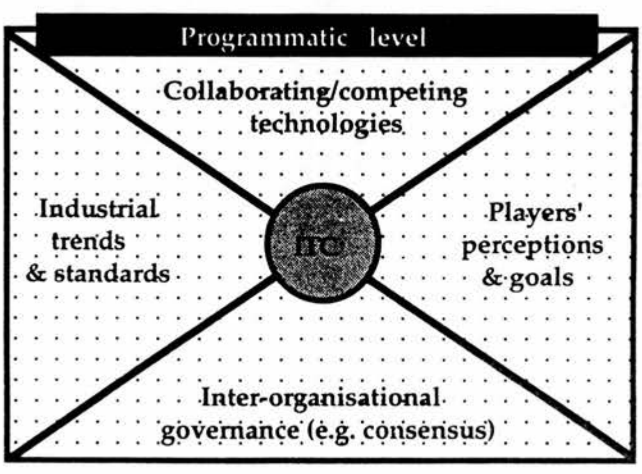
The strength of Molina's analyses resides in the fact that he separates out each factor as a constituent and then integrates them again, by giving them their own character in any particular process. However, in the process of dealing with each of the factors, he also takes into account the macro factors. It appears that he has tried to accommodate the shortcomings of existing sociotechnical approaches and to overcome their failures to accommodate macro social contexts. He deserves praise for his attempt to establish a dialectic for the macro-micro dilemma. However, dealing with macro factors at 'constituent' level does not appear to resolve the dichotomy between constituents and structure completely. The structure seems still alienated from its macro constituents in that although they represent their collective interests to some extent, the analysis still leaves the task of absorbing the abstract entities such as the rules and ideologies which 'structure' embraces, as it is more than a sum of its 'constituents'.

The issue of the institutions and ideologies behind technological development is represented in Molina's use of the term, 'governance', which was recently suggested to fill this gap.

> Governance is the written and unwritten legislation that governs the behaviour, relations, interactions, calculations, transactions and conflict resolution between individuals, groups, departments, companies and so on, in intra- and inter-organisational constituency-building processes as well as inter-constituencies processes themselves. Governance shapes the constituency-building process, but it is also created and destroyed by it. It includes formal and informal organisational structures and decision-making steps, procedures, rules-of-thumb and routines for resource, rewards and punishment allocation. It includes the power relations between individual and collective players at intra-organisational, inter-organisational as well as societal levels. It also includes 'mindsets' resulting from different historical conjunctions such as crises, booms, re-organisations and so on. Governance is critical to sociotechnical alignment and central to the problem of structure and agency and, consequently, to the role of structural power relations in the development of technology. Within constituencies, governance provides a unifying theme for micro- and macro-levels of social analysis (Molina, 1997).

The concept of 'governance' is similar to 'structuration' in Giddens' term. The term 'structuration' embraces both social action which produces structures, and structures per se which govern actions in the form of rules (Giddens, 1993). The concept of 'governance' is useful in linking actors and structures to some extent, in that it gives insights into the abstract entities which are generated and recreated by actors' interaction in the shaping process. This also enriches the capacity for interpreting the embeddedness of actors' collective interests in the shaping process. However, how the macro factors are linked to social agencies' collective interests remain unresolved in the concept of 'governance'.

Figure 1-1 The Diamond of Inter-organisational Alignment (Molina, 1995)



The concept of 'governance' is adapted as an analytical tool for the case studies in this thesis in interpreting the sociotechnical process of technology development and telecommunications network evolution. The 'diamond of alignment', suggested by Molina (1995) is used to illustrate the multiple dimensions of alignment involved in the CDMA case as an analytical framework (Figure 1-1).

1.2.3 Political Economy Perspectives

With political economy perspectives, I try to accommodate macro factors when looking at the shaping process of technology development. Technology development embodies the interests of social agencies; but these are assumed, to some extent, to be ordained by their interests within social relations. For example, Noble (1985) concludes that, "the elimination of human error and uncertainty is the engineering expression of capital's attempt to minimise its dependence upon labour by increasing its control over production" (1985: 116) when he examined the nascent conditions of the automation system. The ideology of engineering, which shapes the design of technology, reflects the social relations of capitalist production.

I intend to clarify the particular social contexts of the NICs we are going to explore. In this thesis, the social relations of state and capital, and state and civil society are positioned as macro factors that shape technology developments. How to define the nature of the state in a society and how to define the role of the state itself is a central subject for social science. Here, I need to indicate how I have looked at the state in this thesis; what is the relationship between the state and society? and how is this relationship embedded in the telecommunications sector? It is not my purpose to enter into a deep discussion about the state. I only deal with those aspects of state theory which may clarify the role of the state and its relationship with society in relation to telecommunications network evolution.

Since the concept of the state is complex, it is important to place boundaries on my level of analysis. In general state theory, we can first conceptualise the 'state' as a particular political leading group; second, we can understand the 'state' as a certain form of organisation and institutionalisation, as a 'government'; and third, the state can also be conceptualised as a superstructure which reflects the infrastructure and the class power which reproduce the dominant social order. In the case of capital, there are three levels of conceptualisation: capital as individual (e.g. one of the *chaebol*, such as *Hyundai, Daewoo* and *Samsung*), capital in its sector (e.g. *chaebol* vs. non-*chaebol*; foreign capital vs. domestic capital), and capital in general (Song, 1994). However, these distinctions are often blurred in reality. For instance, the KII programme I examine in the case studies is established and operated by the state in the concept of 'government', reflecting the interests of the current leading political group. The shift of power from state to capital is discussed in this thesis at the level of 'government' vs. 'monopolistic capital'- i.e. *chaebol.* The debate as to whether the state only represents capital's interests, or whether the state enjoys 'relative autonomy' from capital, has been undertaken in analyses of modern capitalist society within the Marxist tradition (Bonefeld and Holloway, 1991). In this context, the abstract level of state and capital is the highest one described above, as a superstructure and as capital in general respectively.

In this study, I focus on how the state sustains its relationship with society in looking at the transition of telecommunications in the NICs. In the context of NICs, the state is identified as a 'developmental state' (Evans, 1996). When we talk about the 'developmental state', this concept already focuses discussion on the roles the state plays. Further, the term the 'developmental state' still has a bias as it points to a specific function of the state, i.e. 'development'. I focus on the state's involvement as a social actor in the development of a specific sector, telecommunications. With this focus, I aim to understand how the sector is responding to the state's involvement.

1.2.4 The Developmental State and Civil Society in the NICs

It is widely acknowledged that South Korea, accompanied by Taiwan, has moved in the value-added hierarchy of the world system. The role of the state in this so-called 'economic miracle' has been examined by social scientists, particularly in state-centred studies. 'Statists' recognise the role of wide and effective state intervention as a determinant of the 'miracle'. The states' roles in developing countries are highlighted in terms of market creation, capital accumulation and provision of infrastructure (Evans et al, 1985).

'State autonomy' is central to this line of argument. The autonomy here comprises both institutional autonomy and the structural autonomy of the state. The former indicates bureaucratic autonomy, and the latter refers to autonomy from the pressure of various social groups. The state is seen as an actor independent from other socio-economic forces rather than being interpreted simply as responding to the economic interests of capital or civil society (Jessop, 1990: 279). Skocpol (1979) examines the state as an entity separate from social and economic factors, and then argues that the state influences and directs change in both economic and social spheres.

Cho (1996) argues that the over-riding concerns of the state's roles in state-centred studies often overlook social or class conditions, which are essential for understanding the state properly in a specific social context. "States are continually being moulded by societies in return" (Cho, 1996: 10). He divides state autonomy into two sub-concepts: the capability to co-ordinate specific class relations and the capability to co-ordinate potential policy. The former is concerned with specific social conditions, and the latter is associated with the function of specific institutional characteristics, such as bureaucratic structures. Cho claims that the state can autonomously co-ordinate potential policy instruments for economic development together with the co-ordination of class relations, because state intervention can only be implemented by resolving those social conflicts which frequently interrupt it.

Evans (1996) has enlarged the concept of state autonomy by accommodating the relationship between state and society in his recent book, *Embedded Autonomy*. He highlights the 'embeddedness' of social relations in state autonomy, which he sees as providing the basis for the developmental state. He also stresses the significance of the institutional functions in the state's apparatus; the "variation in internal state organisation and state-society relations create degrees of developmental capacity" from predatory to high-level developmental states (Evans, 1996: 72-73).

To elaborate Evans' concept of the 'developmental state', it is not always appropriate to call all the states of developing countries 'developmental states'. If the state takes a leading role in development, we define the state as a 'developmental state'. Evans (1996) suggests that the relationship between state and society is embedded in the state's autonomy in transforming economic development. He has examined the industrialisation process in NICs including India, Brazil and Korea. He reveals the role of the state to support the argument that the state possesses relative autonomy from capital. Emphasis on the state's relative autonomy often goes with a position that considers the state as a rather neutral entity, coinciding with the Weberian emphasis on the role of bureaucracy in the state's apparatus sustaining its relative autonomy from capital at the institutional level. Evans suggests that the relatively successful industrial transformation in Korea is rooted in the embedded autonomy of the state, which traditionally contains a well-educated and stable bureaucracy coupled with political elites. The significance of a stable bureaucracy in the state's apparatus seems convincing when it is associated with the state's autonomy from political turmoil in the Korean context (see section 7.2).

The developmental state internalises its own bureaucracy within which the state apparatuses have 'autonomy'. "They are not, however, insulated from society as Weber suggested they should be. To the contrary, they are embedded in a concrete set of social ties that binds the state to society and provides institutionalised channels for the continual negotiation and renegotiation of goals and policies" (Evans, 1996: 12). Evans identifies Korea as a fine example of the developmental state which illustrates an 'embedded autonomy'. In terms of roles as patterns of state involvement, he categorises the roles of the state as 'custodian' and 'demiurge', which represent the role of regulator and producer respectively. And he makes another categorical distinction concerning the relation between state agencies and private entrepreneurial groups: 'midwifery' represents the situation where the state is involved in promoting local entrepreneurs rather than in policing them; 'husbandary' consists of cajoling and assisting private entrepreneurial groups. Evans argues that the state in Korea has shifted to 'husbandary' on the basis of the successful performance of industry, previously fostered by 'midwifery'. The distinction between 'husbandary' and 'midwifery' is actually blurred as the policies are complex in places. The point of this distinction is that "the very success of state efforts could undercut the political possibilities for sustaining state involvement" (Evans, 1996: 17). 'Embedded autonomy' actually implies specific links with industrial capital rather than with society in general. Evans also raises the question as to whether embeddedness can be built around ties to multiple social groups such as labour.

Evans' highly refined conceptual tool and his empirical evidence shed light on how the relationship between state and society is reflected in the IT sector. For Evans, the IT sector is a tool with which the state structures state-society relations, and how that may shape the possibilities for industrial transformation are investigated. Evans places the concept of development in relation to a global context in examining the IT sector. Development is no longer a local trajectory of transformation; successful development means to locate that country in an advantageous position within the hierarchy of the international division of labour. "In a globalised economy, the global division of labour presents itself as an opportunity for agency, not just an exogenous constraint" (Evans, 1996: 8). Therefore, "state involvement must be taken as one of the socio-political determinants of what niche a country ends up occupying in the international division of labour" (Evans, 1996: 10).

An important point in Evans' study is that the very success of state involvement in development actually causes a change in role from 'midwifery' to 'husbandary'. This argument can be expanded to imply that the power bloc of state and capital in general actually shifts the centre of weight from state to capital. For Evans, the distinction between 'midwifery' and 'husbandary' reveals that what matters is the kind of state involvement rather than how much of it there is. However, the distinction between 'how much' and 'what kind' still matters since any change of states' role may imply that the state loses power, for instance, in the IT industry where domestic capital has established its status firmly. In other words, the state often withdraws its power not because it chooses to do so for reasons of efficiency, but because it is obliged to do so as a result of power relations. This phenomenon interacts with the social relations; and the shift of power relations between state and capital in general is taking place in the current Korean society (see section 7.2).

While Evans' contribution sheds light on the role of the state by examining a particular industrial sector, this thesis examines the telecommunications sector whose changes and development reflect the particular formula of relationship between the state, capital and civil society as macro social constituents shaping the industry.

1.2.5 The Authoritarian Mechanism

I propose that an 'authoritarian mechanism' is operating in the development of telecommunications in the Korean context. We need to differentiate here between general control in the telecommunications industry and its control in Korean society specifically. Telecommunications has been regarded as an area where state intervention is taken for granted. Then, what is new and what is particular to the Korean context, and why do I refer to the 'authoritarian mechanism'?

The concept of 'authoritarian mechanism' is a type of governance reflecting the particular social relations in Korea. It is largely assumed that social agencies accomplish their interests in processes of 'negotiation', albeit that negotiation is often distorted by power relations operating between agencies. The authoritarian mechanism implies the lack of any institutional space for negotiation.

The authoritarian mechanism in Korean society is linked with the concept of the 'developmental state' defined in section 1.2.4, which plays a role in economic development as both producer and policy-maker. There are two meanings attached to the authoritarian mechanism in the Korean context. The first meaning is the lack of space for negotiation in deploying policy. This stems from the fact that establishing the state's role in distributing resources and controlling the private sector requires strong authority (see sections 7.2 and 7.3). The second meaning focuses on exclusion, and can be complemented by Evans' term 'embedded autonomy' (Evans, 1996). State intervention eventually embeds the interests of industrial capital, while still retaining its relative autonomy from capital. There is another side to the embeddedness coin, however. The embeddedness of interests of industrial capital coincides with the exclusion of labour in the relationship with society. The exclusion of one part of the society requires authoritarian power on the part of state, which often brings about outrageous repression.

This authoritarian mechanism is evident in the transition of shifting power relations between state and capital reflecting the social class conditions and state-class relations in Korean society (see section 7.2). This provides a social basis for understanding political and economic factors and changes in telecommunications in Korea; and it is illuminated in the analysis of case studies (see section 12.4).

1.2.6 Telecommunications Network-based Services and A 'Strategic Model'

Mansell (1990) proposed the concept of Telecommunication Network-based Services (TNS) as a comprehensive analytical framework as well as a useful perspective on today's network evolution. This framework recognises the indistinguishable nature of "infrastructure" and "services" in telecommunications networks because of an overlap between software-related functions embodied in networks that support message transport, and those that support data processing, protocol conversion, etc. All telecommunications services require infrastructural resources. They can be managed, owned or operated by public or private organisations depending on the sector and the country.

> The concept of Telecommunication Network-based Services (TNS) which bridges the infrastructure and service dimensions of telecommunications by emphasising the relationships between hardware, software and services, provides a cornerstone for an analytical framework for infrastructure development (Mansell, 1990: 510).

The concept of TNS does not seem to be a strictly defined and completed analytical framework. Rather, it provides us with a tool to identify the open space where the initiative to control telecommunications network is imposed by social and economic factors, as well as being a response to the characteristics of telecommunications. The concept accommodates the process of production and consumption in telecommunications as well as revealing how the innovation process is shaped by power relations.

Three important observations reflecting characteristics of the TNS concept are suggested (Mansell and Jenkins, 1992): first, account should be taken of the fact that different emphases will be given by various participants in a communication relationship to alternative modes of communication in the light of their economic, political and cultural milieu; second, the transformation of global telecommunication networks is, in part, attributable to political group dynamics which create incentives to exit from the monopolistic telecommunications systems of the past; third, a taxonomy for TNS must permit distinctions to be drawn between alternative forms of ownership and control. In this thesis, the concept of TNS is employed as a perspective to evaluate the implications of different arrangements for infrastructural development.

While the TNS concept provides a comprehensive model accommodating the technical and institutional spheres, Mansell (1993a) uses the concept of a 'strategic model' which is compared to an 'idealist model'. These models represent the main perspectives on the relationship between technical change and institutional concerns in telecommunications. The idealist model assumes that telecommunications supply should be treated like any other competitive commercial activity; the strategic model assumes that it is unlikely that there will be a ubiquitous diffusion of advanced communication services and that there will be disparities and uneven development of the terms and conditions of network access. She suggests that the 'strategic model' leads us to see how negotiations and design considerations are shaping the characteristics of the telematics network system, comparing that account with the idealist model which conceals the contradictions and conflicts within the global communication environment.

The distinction between an idealist model and a strategic model is not an instrument to elucidate social phenomena with a 'value free' approach, in the sense that Weber (1949) suggested the 'ideal type' be used as an instrument for interpreting social phenomena especially for comparative social study. Weber had emphasised this concept as most social scientists in Weber's period often served the dominant political power without establishing an appropriate scheme of social science research. Whereas the 'ideal type' implies a 'vacuum' free from the social and political interests which a researcher possesses, the distinction between the 'idealist model' and the 'strategic model' embraces the political intentions which the views and interpretations of the research imply. The models are generated for indicating the categories of views and positions in looking at the changes in telecommunications today in the first place; and the views and positions which players produce in the process of network evolution also shape the new order.

Mansell suggests the superiority of the 'strategic model' if we are to build a space where institutional and public efforts contribute to orienting telecommunications development. This reveals her awareness that present telecommunications development is being constructed by political and economic incentives among the agencies surrounding the sector, rather than following a neutral technological trajectory. Mansell identifies two mythical notions in the changing world of telecommunications;

> the first is that the rapid diffusion of the most advanced public network capabilities is in the interests of all telecommunication users ... the second myth that should be abandoned is that technical trajectories are narrowly circumscribed by options such as those debated by the technical engineers charged with designing the intelligent network (Mansell, 1993a: 227).

Mansell believes these are myths because this trajectory is shaped by social, economic and political action and so can, in principle, be reshaped. The public network, for instance, could be designed to fulfil the requirements of large users, whilst it may hardly meet conditions which reflect public interests, as the definition of public interests can be quite diversified.

Mansell's works shed light on the *process-oriented* focus in examining current changes in telecommunications. A '*process-oriented approach*' (Mansell and Silverstone, 1996) reveals the political and economic interests of the players and draws upon the issues of infrastructure/profitability, regulation/liberalisation, and globalisation. Mansell comments;

> The location of empirical research on the social and economic implications of ICTs within this process-oriented framework offers a way of recoupling the analysis of user and producer relationships in the ICT field and it suggests avenues whereby simplistic deterministic analyses of the social or technological 'impact' of ICT can be transcended (Mansell, 1994a: 336).

Because technical solutions for network evolution might determine social actions as well as be influenced by social interests, an analysis which combines the technical sphere with the social sphere is crucial in conducting process-oriented research.

> By analysing the scope for choice in the development and implementation of information and communication technologies, we find opportunities for action that could, we believe, ameliorate some of the disruptive aspects of innovations in

> advanced information and communications technologies (Mansell and Silverstone, 1996: 6).

This viewpoint coincides with the notion of the social shaping of technology, which also attempts to identify opportunities to influence technological change, so as to offer "the prospect of moving beyond defensive and reactive responses to technology, towards a more pro-active role" (Williams and Edge, 1992: 5).

There seem to be two substantial axes to Mansell's research focus. One axis is the technical change from analogue switching to the digitalisation of networks, and the other axis is the political and social realm. These two axes are located in space through invoking the changing order of telecommunications as a third axis. The perspective on the changing order in telecommunications is suggested as the 'strategic model'. Given that technical innovation is a critical element of network evolution, the technical axis is not pre-ordained to travel in a specific direction, for network design largely resides within the political and economic environment. This argument is quite convincing in terms of the social shaping of technology viewpoint. However, the role of the political axis is rather narrow because research analyses largely remain in the realm of regulatory regimes, and in the interests of players, without identifying the structural political and economic factors. The changing order in telecommunications should be spelt out in relation to similar processes in other social and economic spheres. Mansell actually acknowledges, "in spite of the asymmetries in their development and use, the prospect of accessible, easy to use, interactive communication networks is consistently associated with beneficial social and economic transformation" (Mansell and Silverstone, 1996: 4). In this study, I try to accommodate the structural political and economic factors building on the strategic model.

This viewpoint is crystallised in interpreting the transition in telecommunications as we see in the next section.

1.2.7 The Transition in Telecommunications

Competition and privatised telecommunications carriers are imposed in a liberalised environment where the market principle dominates. The industry is moving from a public sector to a profit-making industry. And the profit-making industry becomes the means for realising national competitiveness in particular countries. This new order, however, embodies the power structure surrounding the industry. Chapters 3, 4 and 5 review the changing order by showing it is not something following a natural path, rather, it is being formulated in a strategic intention. Melody comments;

> The most relevant market model for examining the consequences of competition in the information age is one of indeterminate, unstable oligopoly wherein the TNCs (Transnational Companies) deliberately employ short-run pricing strategy to achieve long-run entrenchment and monopoly power in national markets, foreign and domestic (Melody, 1994: 29).

With the strategic model, we need to identify what forces shape the new order. The state, global carriers and capital, national carriers, and the general public can be identified. With regard to the state, even though government intervention is being withdrawn in the form of liberalisation and deregulation, the state remains prominent in another form of government intervention, i.e. in the realm of industrial policy.

> Increased responsibilities in telecommunications policy fell to states as many were expanding their role in economic development policy. For reasons associated with national policy, structural economic change, economic distress, and internationalisation of the US economy, states have become active in economic development. In many states, development concerns find their way into discussions of telecommunications policy (Wilson and Teske, 1990: 167).

With respect to the carriers, global oligopolies, which support the global expansion of capital, together shape the global telecommunications network with the growing significance of service-independent network architecture. "The actors in this globalisation process are orienting themselves towards the international market and domestic networks are being modernised to support these international activities" (Mansell, 1993: 13).

The political power of user groups, global capital and general public users are not so easily identified. In particular, in the case of general public users, it is often simplistically assumed that public organisations support public interests.

> Such user groups and their political allies (e.g., finance and economic ministries) may be crucial in launching a reform process and keeping it on course. At the outset, however, the political power of telecommunications users is likely to be diffuse and quite limited compared to that of the dominant carrier and its employees, who are usually unionised. Indeed, given that the PTT is typically one of the largest employees in the countries and that its employees enjoy a privileged position (in terms of status or pension rights), it generally will not be possible to restructure the

> dominant telecommunications service provider unless employment issues are adequately addressed (Smith and Staple, 1994: 79).

The unionised employees of PTTs may argue for their own rights, but their political activity needs to be appreciated as more than an employment issue in a situation where the general public is not identified as a political group (see sections 9.2.5 and 13.2).

The relationships among the relevant dominant actors tend to threaten public interests in the name of national interests. Melody (1994) suggests that liberalising the market for monopoly capital in the domestic market in the name of national interests often blurs monopoly capital's relationship with public interests. "Home governments tend to exhibit greater tolerance for increased domestic monopoly power because it enhances the power of their resident TNCs (Trans-National Companies) in international markets" (Melody, 1994: 25). This change from a public service to a profit-making industry is taking place in a situation where government policy favours TNCs' domestic monopolistic power in the name of meeting national interests.

> Even monopolistic exploitation of domestic consumers becomes tolerable as providing the necessary strength, power, and resources to compete successfully in the global markets ... In this new political economic environment, the conception of the public interests within a nation also change. Traditional concerns about the prices and quality of public utility services and the universality of coverage of public service declines (Melody, 1994: 26).

However, how the wealth accumulated by TNCs may benefit civil society still remains open to question.

> The international success of home-based TNCs, as measured by sales, profits, and a favourable balance of payments, becomes a primary objective of government public policy. This success is viewed as fuelling domestic employment, productivity, and national wealth. Domestic consumers and social policies are seen to benefit from the trickling-down of benefits from successful TNCs. How social services will be funded from this wealth accumulated by TNCs, when government policy is directed to subsidising their competitive efforts in global market rather than taxing away their monopoly profit, remains a mystery (Melody, 1994: 26).

Enhancing network functions certainly serves specific consumers such as large companies rather than the general public. The problem raised here is that public users also share that network. It is a more visible question to ask, how regulation prevents payments generated by the general public from being diverted into supplying enhanced services, rather than how the general public could benefit from those enhanced services. The strategic model can accommodate a positive strategy to enable the general public to access enhanced services.

1.3 Aims and Scope of the Thesis

My research starts from a belief in social equity. By elucidating the process of network evolution and technology development, I hope to contribute to establishing an appropriate way to meet public interests in telecommunications.

This thesis is an attempt to combine the 'social shaping' tradition in technology studies with a political economy of telecommunications evolution, through an empirical study in the context of a NIC. This thesis identifies the sociotechnical elements shaping telecommunications and examines the changing technology and the role of players in specific telecommunications development projects. Within the perspective of a political economy, the actors involved in telecommunications network evolution are deemed to represent macro structural forces such as the state, capital and labour. The sociotechnical elements, including social agencies, are identified as concrete entities; and the political and economic interests of those social agencies are interpreted within the perspective of a political economy. The main research question considered is how political and economic interests are embedded in the process of introducing and developing new services in network evolution. In particular, I highlight factors emerging in the transition of telecommunications from a public service to a profit-making industry.

The concept of universal service inspired me from the beginning of my research as it is one of the recognised policy goals in meeting public interests in telecommunications. Universal service has been challenged because the monopolistic provision of telecommunications which previously provided universal service has collapsed, hence, it is being reinterpreted in the new competitive environment by regulators and Telecommunications Operators (TOs) in terms of scope and policy goals. The issue of universal service is highly debated in the process of restructuring, in particular in the policy making realm. The range of the debate seems largely settled by now in a way which, on the one hand, recognises basic telephone service as the scope of universal service in current telecommunications, but on the other hand, acknowledges that a review of the scope of universal service will be needed in the future in order to reflect changes in services and network functions (see section 3.5).

This thesis reviews the concept of universal service as a useful reference for examining changes in telecommunications and for how players interpret public interests in the telecommunications industry. It concerns the political and philosophical spirit of universal service as a reference for building public interests in the new environment, rather than focusing on the technical issues of achieving universal service. This research approaches the universal service issue in a rather implicit and indirect way by exploring network design and technology development processes.

This thesis focuses on the Korean telecommunications industry. It examines the changes in the market and technology development systems in general, and the specific cases of the Korea Information Infrastructure (KII) programme and the digital mobile communications system, Code Division Multiple Access (CDMA) development. KII is a programme established by the Government as a national initiative for advanced telecommunications network design mainly focused on fibre optic cable. Digital mobile communications system development has been implemented to improve mobile communications network capacity and quality, under heavy market pressure.

The development of KII and CDMA is taking place in the context of a restructuring of the telecommunications industry. The policy direction and national R&D systems have been challenged by globalisation and changes in the social power structure. Globalisation and market conditions are interacting with the internal social dynamics represented by the evolution of power relations between such bodies as the state, capital and civil society.

The case studies reflect the interests of diverse agencies: the Government, Korea Telecom, newly emerging competitors in the private sector, and the community. The KII programme shows how the network design is being implemented under the Government -led national initiative. It exemplifies a process of the change to telecommunications as it embraces policy concerns in regulatory schemes, the concerns of Korea Telecom, the changing politics of the present political power structures, and the interests of capital. The CDMA development was chosen in the expectation that it could show the direction of change in telecommunications because mobile communications has already moved to a profit-making enterprise.

Both KII and CDMA share common ground where developmental concerns impinge. KII became an element to propel the restructuring of telecommunications to attract private sector participation as a result of a political push for development. By contrast, the CDMA development was propelled by market demand as well as by developmental concerns, which induced capital's interest in both mobile communications service areas and equipment manufacturing from the beginning.

With the KII programme, the B-ISDN project expands its governance from purely technological concerns, which the PTO and a public institution took part in, to a situation where multiple constituents - the Government *and* industrial capital - all came to participate in the process. Within the process of developing CDMA technology, we see a transition in the existing R&D system. The existing R&D system is being challenged by shifts in power. The power of capital emerges in the area of both technology capability and funding. This results from capital being more autonomous than before and is coupled with a decline in state control. The R&D system and the ideology of indigenous technology are challenged by the newly emerging order.

The findings of this thesis show that the changes in telecommunications, as a complex of technologies and social institutions, is subject to social shaping rather than technology itself determining how institutions and markets change. The network evolution is not fixed or pre-ordained to travel in a specific direction. The network design embodies the political and economic interests of players such as emerging large users, existing residential and small and medium sized users, existing PTOs, public institutions and industrial capital.

1.4 Outline of Thesis

This thesis is divided into four parts. Part I introduces the framework of the research design and the methods of the study. Chapter 1 introduces the main analytical concepts and research framework together with the aims and scope of the study. Chapter 2 elaborates the research questions, describes how the research was conducted and introduces the cases I explore in the thesis.

Part II presents the conceptual background of the research, i.e. the transition in telecommunications. Chapters 3, 4 and 5 review the literature, exploring the issues associated with technologies and institutions in the transition in telecommunications. These chapters elaborate the scope and focus of the research. I started this research with the intention of exploring public interests and, thus, changes in the concept of universal service. Accordingly, the history of universal service, the rhetoric behind it and the current disputes surrounding universal service are dealt with in chapter 3. Redefining the concept of universal service involves assessing newly-defined public interests. This is taking place in the context of a transition in which social agencies are shaping technologies and institutions anew. Chapter 4 explores changing features of the telecommunications network which embody technological change and social and economic interests. It provides a perspective on telecommunications which encompasses institutional and industrial aspects of the current changes to telecommunications. Chapter 5 examines the institutional issues surrounding the transition, such as globalisation, liberalisation and privatisation and issues concerning NICs. Chapter 6 concludes the literature review of chapters 3, 4, and 5.

Part III presents the empirical findings of the study. It explores the national and sectoral context as well as the two case studies. Chapter 7 introduces the social and economic characteristics of Korea. Chapter 8 introduces the general features of the telecommunications industry in Korea. Chapter 9 reports the changes in, and challenges to, the telecommunications industry by showing how liberalisation and a changing R&D system are emerging in the context of players' interests and an open market environment. These three chapters provide a background for the two case studies. Chapters 10 and 11 report the cases of KII and CDMA. These chapters are structured to show how the process of development reflects the interests and visions of players, following the analytical framework described in section 1.2.

Part IV presents the analysis and conclusions of the study. Chapter 12 elucidates the shaping process of telecommunications as reflected in the two case studies and the global context, using the theme of governance. The governance of the process in which KII and CDMA were developed and implemented reveals three sub-themes: political embeddedness, global embeddedness, and interaction with national power relations. These sub-themes articulate the analytical abstraction to identify the sociotechnical elements in the shaping process and they are integrated into the theme of the 'authoritarian mechanism'. Chapter 13 returns to the topic of public interests in network evolution, building on themes developed in chapter 12. I suggest that the shaping process implies the possibility of public participation by addressing the public interest issues raised in network evolution. The concluding chapter 14 reflects on the main contributions of the study, suggesting theoretical and policy implications.

Chapter 2: Research Design and Method

2.1 Introduction

The research I conducted mainly employed a qualitative research approach. This chapter elaborates research questions in section 2.2; and introduces case studies in section 2.3; the data collection process in section 2.4; data analysis in section 2.5; and reflection of the research process in section 2.6.

2.2 Research Questions: Towards Meeting Public Interests in Telecommunications Network Evolution

Based on the main analytical concepts and research framework elaborated in section 1.2, this section suggests research questions which also integrate the issues surrounding the transition of telecommunications addressed in chapters 3, 4, 5 and 6 in examining the case studies to follow. The research questions I would like to pursue aim to examine the process of the transition in telecommunications by a focused empirical study.

The way we choose to approach something (i.e. the research framework) shapes what we see. Main concerns of this research are: the governance that rules shaping process of network evolution (see section 1.2.2); how social agencies build their capabilities in the spheres of production and consumption within the contradictions that emerge from the changing order (see sections 1.2.6 and 1.2.7); how this order reflects the interests of players in the design process of network evolution and technology development.

These concerns about network evolution are developed into detailed research questions as follows:

What are the sociotechnical determinants of the evolving telecommunications network in Korea and how do they operate?

First, it is essential to examine the broad power relations surrounding network evolution. The actors are: the state, supercarriers and capital in a global dimension, national PTOs, and the general public (see sections 1.2.7 and chapter 6). The process of the changing nature of the telecommunications network and the changing functions of players are deployed in terms of a changing order in telecommunications, and are strategically directed by those actors within the context of globalisation and liberalisation.

Second, I try to identify the political and economic interests in the introduction and development of specific newly emerging services and network functions, and examine how these are embedded in network design and technology development.

What issues are raised by the restructuring of telecommunications in Korea ?

Third, how is globalisation and liberalisation affecting network evolution in NICs?

Fourth, I shall examine what the policy priorities in the process of decision-making are, how those priorities are reflected in network evolution. In the context of NICs, the questions are interwoven with issues raised by the status in the hierarchy of the international division of labour.

Fifth, how does globalisation interact with the social relations of Korea in shaping network evolution?

What are the prospects for 'public interests'?

2.3 Case Studies

Once I set up my research questions and general perspectives, I decided to conduct case studies in which the process of technological development and network evolution can be investigated by means of in-depth interviews and document sources. A case study enables a researcher 'to capture individual and unique variation'. It is useful in the situation where a researcher can identify cases rich in information and where one needs to understand some particular problems or situation in great depth (Patton, 1987).

I adopted 'purposeful sampling' (Patton, 1987) to provide insights into my research questions. Purposeful sampling involves choosing a critical case in terms of its usefulness and credibility. The criteria with which I chose the case studies are: (i) the case should be critical to the evolving telecommunications network; (ii) the contents of development should be advanced enough to reveal conflicts between universality and efficiency; and (iii) the composition and dynamics of the cases should be linked with the research questions I would like to explore. In order to address the public interest issues in the technological development process, and the shift from public to private governance of telecommunications, a comparative approach was adopted, which are case study focusing on a government initiated and controlled project and one focusing on a more market led, decentralised project.

I also chose Korea as the place where my case studies were conducted. Because of the strength I had as a native speaker, my background knowledge about society and the telecommunications industry in Korea, and the limited time and financial resources available, I decided to take advantage of being Korean. Also, Korea is generally considered as an outstanding example of NICs with its economic performance and developmental ambitions (see sections 1.2.4 and 7.3). I was able to use my background knowledge and fluency in the language to examine social phenomena in great depth.

In identifying critical cases for research purposes, my existing knowledge about telecommunications in Korea was quite helpful. There were not so many players in the telecommunications industry (see section 8.3): the Ministry of Information and Communications (MIC) as a regulator, Korea Telecom as a network operator, Electronics and Telecommunications Research Institute (ETRI) as a public R&D institute and the private sector as manufacturers. The organisations I needed to visit were already identified apart from private sector participants which depended on the projects they were involved in. I was aware that the R&D chain in Korea was rather simple in terms of government initiative; ETRI's role of organising; Korea Telecom's procurement power; and manufacturers' compulsory co-operation for technology development in the stable R&D chain (see section 8.4). The cases could be chosen from a list of R&D projects in ETRI; there would be no danger of convenient sampling. Quite a few of the technology development projects listed by ETRI seemed to be relevant to my research concerns.

In addition to the list of R&D projects in ETRI, I encountered the KII programme (Information Super-highway Project at that time) before going into the field through telephone discussion with colleagues in Korea. The KII programme was launched officially in November 1994, but it had been prepared and developed for a year previous to this. KII was already highlighted in journalism and among the people who are working in the telecommunications sector. The information super-highway programme seemed to be a case in which many kinds of players were involved with various positions suggested through negotiation, translation and so on, and in which mechanisms to conduct technological development in relation to network availability could be observed. However, as the programme was about to start, I was concerned as to whether this case would provide enough information and insights into my research questions.

I was aware of the digital mobile communications system development in which KMT (Korea Mobile Telecommunications Co.)[1] makes a considerable investment. This project was attractive in the sense that it could provide a counter vision of universal access, since mobile communications services have not been expected to offer universal access.

There were two other cases I was interested in. TDX development was strongly recommended by my colleagues and people who know this field well. After all, TDX is a good example of indigenous technology in Korean telecommunications; and good progress has been made. Although this case is far more famous than the other projects, it did not seem to fit the demands of my research questions properly. While my research questions are focused on the developmental process in the transition of telecommunications, it was rather obvious that TDX development was being conducted in stable conditions where the R&D chain was stable and where the purpose of development was to satisfy the basic demands of the telephone. ATM exchange system development was also considered, as it is becoming a technologically substantial element of network evolution nowadays.

2.4 Data Collection

[1] The name of KMT has been changed into SK Telecom in 1997. And previously KMT was called KMTC before its privatisation in 1994. In this thesis, I refer to this company as KMT in the following chapters because it is 'KMT' that was called in the period when my case study was conducted and when this company's role was significant in my case study.

This section describes how the fieldwork was conducted. This includes overview of fieldwork (2.4.1), archival data collection (2.4.2) and the interview process (2.4.3).

2.4.1 Overview of Fieldwork

I decided to identify critical cases in early stages of fieldwork, as my information seemed limited due to my recent absence from Korea. The fieldwork began with inquiries into which cases would be appropriate for my research questions and feasible in terms of people and time schedules in pilot interviews. General policy orientation as well as the crucial R&D activities in relation to network evolution and the main players involved were also identified at this stage. After having been in Korea for about two months and conducted pilot interviews, the cases I should explore became clearer. My fieldwork was carried out between the middle of October 1994 and the end of February 1995 (the first visit), and in June 1996 (the second visit). During the first visit , KII was officially launched, attracting substantial media interest and the CDMA project was reportedly in progress. People in the sector were talking both negatively and positively about these projects.

My fieldwork has two phases: the first visit (October 1994 - February 1995) and the return visit (June 1996). The return visit was scheduled for two reasons. One is that the cases were still in progress on the first visit, particularly the case of KII, which had been just launched in November 1994; and the case of CDMA was still ongoing. CDMA was reportedly successfully finished at the end of 1995, and I wanted to explore the full process of CDMA as well as to catch up on changes and issues surrounding the implementation of the KII programme. The other reason is that I found some gaps and missing points I wanted to explore in the story and analysis I had about case studies in 1996. To some extent, this is relevant to the first reason, but I also found I developed my views and concerns on the cases during the return visit more than I had on the first visit. Although the return visit was brief, I managed to get a lot more critical information and views from the interviewees. This was partly because the programme was being implemented and partly because I had more constructive ideas on what was critical for my research questions, which led to more efficient and productive interviews. On the return visit, I approached some new interviewees as well as reinterviewing some of the critical figures on the projects.

Data collection in qualitative methods constitutes in-depth, open-ended interviews, direct observation and written documents. In-depth and intensive interviewing is one of the major ways in which a researcher understand the perspectives, feelings, and knowledge of the people (Patton, 1987). In my fieldwork, data collection was conducted by interviewing people involved in the cases; this material was complemented by collecting archival data.

I exploited fully the informal network and knowledge I possess through my work experience in the telecommunications policy research field in Korea. I used to work for the Korea Information Society Development Institute, a public institute conducting telecommunications policy research.[2] The experience was helpful in building contacts from the beginning of fieldwork and in accessing data in the relevant organisations. I have my own personal resources in other public organisations such as ETRI, the MIC and Korea Telecom through my work. In addition, I was also advantaged in that many of my former colleagues in the Institute have moved to the telecommunications industry. As the Korean telecommunications industry is moving quite rapidly in the process of introducing competition, a number of new players have emerged (see section 9.2.2). Those organisations and service providers needed human resources whose expertise and knowledge they could exploit. The Institute I used to work for became a pool of human resources.[3] I used these resources fully in the process of data collection.

2.4.2 Archival data

After I identified cases, I conducted library work, including searching newspapers and collecting policy research reports and academic papers, which provided updated information on general trends in the telecommunications field in Korea as well as basic data

---

[2] For more information on KISDI, see section 8.3.

[3] There is the other reason behind this phenomenon in terms of organisational problem within KISDI. The promotion policy in KISDI prevented researchers who do not have PhD degree from being team leaders despite the fact that they became experts in the telecommunications field with substantial contributions in terms of research results. The well established researchers moved to the telecommunications industry sector because of the frustration they had in the organisation.

directly relevant to the cases. The data collected by library work were mostly used for developing more concrete interview questions by identifying issues raised with respect to the political and economic interests of players. Because I wanted to get substantial information about the process as well as the views and interests of the players, preparing myself with a rich background knowledge was quite critical in terms of depth of interview as well as the attitude I wanted to show to the interviewees. I think that when interviewing professionals, if the purpose of the interview is more towards information on the process rather than views they possess per se, the interviewer should also come equipped with an in-depth knowledge of the process. I was very aware that the more knowledge I had, the more I could get.

2.4.3 Interview Process

Starting the case studies, I conducted interviews in the following three categories: changes in the telecommunications market and universal service; the case of KII; the case of CDMA. I initially identified organisations involved in those categories (see section 8.3). The interviewees were not necessarily exclusive to all of the three categories. For the changes in the telecommunications market and universal service, interviews were pursued in Korea Telecom, Korea Telecom Trade Union, Korea Mobile Telecom, DACOM and ETRI. In the case of KII, the interviews were conducted mainly within the Task Force which was launched in November 1994. The Task Force was formed by staff delegated from relevant organisations such as the MIC, the NCA, Korea Telecom, DACOM, KISDI and ETRI. I also conducted interviews separately with staff in Korea Telecom and ETRI. For the case of CDMA, I identified players such as the MIC and ETRI (organiser); *Samsung* Electronics Co., *Hyundai* Electronics Industries Co., LG Electronics Co. (manufacturers); KMT and *Shinsegi* (network operators).

I approached interviewees starting with the people who were relatively easy to contact through my work experience and personal feelings towards the organisations. As my interviewees were willing to give me names of people who could possibly respond to my interview, the network gradually expanded once I started interviewing. Thirty four interviews were conducted with twenty nine people (some interviewees were revisited). The interviewees are listed in Appendix 1. Each interview lasted on average, 1-2 hours. I recorded interviews if the interviewee permitted, but I relied on note-taking for half of the interviews. Some interviewees explicitly refused to the interviews being taped, and in these cases I did not try to persuade them because many people in the Korean society do not like being recorded for personal security reasons. For example, I did not even ask to record government officers as I was sure that tape recording would annoy them and would render their interviews useless.

Interview questions were continuously built up during the fieldwork period rather than having been completely prepared before going into the field. The more I found out in terms of issues and changes through the process of interviewing, the more I was able to ask when interviewing people. The main themes of inquiries are summarised in Appendix 2.

For the category of changes in the telecommunications market and universal service, I firstly relied on policy reports and newspapers in finding out the factors which have been changed since I left Korea in late 1993. The interviews were mainly focused to illuminate the interests and views of the players.

During the first visit, I started the fieldwork by approaching Korea Telecom Trade Union (KTTU). KTTU was chosen because it seemed to be actively raising issues surrounding telecommunications restructuring with criticisms based on public interests and supporting the position of Korea Telecom. Thanks to KTTU's help, I managed to expand my interviewees in Korea Telecom. Views on the R&D system in the changing environment were also covered by two members of staff in ETRI when I interviewed them mainly about technology development within the KII programme.

During my first visit, I collected some policy documents and reports on changes in telecommunications and interviews with Korea Telecom, KTTU and ETRI. Competitors' views were covered on my return visit by interviewing members of staff in Korea Mobile Telecom and DACOM. The interviewees in Korea Mobile Telecom and DACOM are my previous colleagues, who are positioned at director level in the organisations which are mainly focused on business strategies.

From the category of changes in the telecommunications market and universal service, there were eight interviewees: 2 from KTTU, 3 from Korea Telecom, 2 from ETRI, 1 from DACOM and 1 from KMT.

For the case of KII, I started an interview with a member of staff in the National Computerisation Agency (NCA). In the NCA, I have a former colleague who advised me on people I should approach, as well as being willing to be one of my interviewees. I encountered a champion figure in the Task Force in building the idea of KII. As well as staff from the NCA, I talked to people in Korea Telecom and ETRI on my first visit.

One problem was that the projects people talked about were not definite. Although KII was already launched, that was at the initial stage of the programme, and many people said 'nothing is visible'. What I had in my mind when interviewing people was that, although nothing was visible at that stage, it was worthwhile to investigate the case as my research questions are towards players' interests as embedded in the programme. Time was too limited to look at what was actually happening reflecting these interests; I had to be content with identifying players' interests in and expectations of the case.

On my return visit, I had precious opportunities to catch up on the formal and informal changes and problems which had occurred in the process of implementing the plans. The interests of players were more visible than they were on the first visit. I revisited some of the interviewees from my first visit to the NCA and ETRI, and interviewed some more people in the MIC, the NCA and Korea Telecom.

From the KII case, there were twelve interviewees, including: 4 from the KII Task Force (2 delegated from the NCA; 1 delegated from Korea Telecom; 1 delegated from the MIC), 2 from the NCA, 3 from ETRI, 3 from Korea Telecom.

Even after the return visit, I was informed of the critical change by one of the interviewees in the NCA. Because the KII case is an ongoing programme, I was often in the position where I had to judge whether the new materials and changes were critical enough to change my argument and contents. For instance, as one of the critical phases of the process of KII construction, the Government introduced radical competition in local telephony to boost KII construction using private sector participation. In this phase, I relied on some newspapers I searched on Internet and by simple telephone inquiries rather than face to face interviews.

When I chose the CDMA case, I was rather optimistic about getting interviews and materials as I thought the development was already processed to a point that I could see the processes in-depth. I identified the formal development features of the project. Among the three categories, the CDMA case was the most difficult to build contacts as I did not have any personal or experienced links.

I managed to open contacts by initially interviewing two members of staff in the MIC. It is generally difficult to approach members of staff in government departments in Korea, because they do not tend to say things to the people for whom they do not feel they should take responsibility. I took advantage of having been a researcher of KISDI when I approached the interviewees. In the interviews, I got very little information from them. My impression was that both were quite reluctant to be interviewed by me. One of the government officers in the MIC allowed me to look through formal documents which were produced for meetings in relation to the CDMA development. However, I was not permitted to photocopy them. His response was very defensive when I asked why the MIC chose CDMA as a technology standard. At that time, I was not aware that the MIC was having a hard time persuading parliament and journalists about the matter. I became aware there was something going on through his defensive attitude.

My fieldwork on the CDMA case on the first visit only covered ETRI, the MIC, and KMT, with rather poor data collection. I managed to get formal documents and parliament discussion papers through ETRI. With this procedure, I only figured out what was happening formally, and what the issues were surrounding the development. On my return visit, I obtained manufacturers' views. It was a very critical point in terms of my confidence about the CDMA case when I managed to interview people in *Samsung* and *Hyundai* on the return visit, as they provided me with their perspectives on the critical phase of the development and their own views, which helped to improve a substantial amount of points in my research. Apart from the director of LG, who refused my interview, I met two directors of these manufacturers. This amounted to only two interviewees, but as they were the team leaders of the development in their organisation, the interviews were productive in terms of validity of information and of representing the interests the organisations possess.

The interviews with staff in the network operators: KMT and *Shinsegi* were conducted on my return visit using my personal network. Two members of staff in *Shinsegi*, who are my previous colleagues, were interviewed together. Being relatively close to the interviewees, I had the advantage of getting more lively and spontaneously offered views from them. Some of their comments implied that there were quite a few criticisms surrounding the procurement process as well as the development process, which I rarely got in interviewing people from the other organisations in rather formal atmospheres.

There were twelve interviewees in CDMA case including: 2 from the MIC, 4 from ETRI, 1 from *Hyundai* Electronics Industries Co., Ltd., 1 from *Samsung* Electronics Co., Ltd., 2 from *Shinsegi* Telecom, Inc., 2 from Korea Mobile Telecom.

2.5 Data Analysis

Data analysis was conducted using the analytical framework outlined in section 1.2. In analysing the actual process of organising and interpreting the data, I tried to illuminate the development and implementation process of the case studies in terms of reflecting analytical themes, rather than simply describe them.

My analysis is not towards testing an established theory or establishing a new theory. There is no hypothesis to prove. Rather, accounts from social shaping of technology and political economy perspectives stand to comprehend the wide variety of social phenomena. These are underpinning my sense to pick up and to interpret critical comments and factors in interview and archival data. This took place in three broad processes.

First, I tried to identify actors at the institutional levels. This is the main message of the SST tradition and in particular Mansell's contributions in telecommunications research. The interview questions were designed to elucidate the underlying political and economic factors shaping the development and implementation of particular technology development projects.

Second, I organised and structured the data, by extracting factors emerging in the complexity of the phenomena, in especially the 'sociotechnical' as dynamic ensembles, rather than by differentiating social factors from technical factors (see section 1.2.2). Because identifying 'determinants' in both 'social' and 'technical' sphere separately is becoming meaningless, even, misleading in understanding design process, an analysis which accommodates 'social' and 'technical' spheres holistically seems crucial.

I organised the contextual data by themes which present social and political factors at global, national and sectoral levels:

• Understanding global changes in telecommunications (chapters 3, 4, 5 and 6)

• Understanding national power structure based on political economy perspective at national level (chapter 7)

• Institutional changes including liberalisation and privatisation; changing role of players; policy priorities; institutional factors at sectoral level (chapters 8 and 9)

The case studies data, I initially organised are: factors emerging from the formal procedure of each case illuminating technological tasks; key players and their roles and interests in the development process. However, in presentation, the data above are restructured into the following two points in illuminating the 'process' of development and implementation as 'sociotechnical' rather than separated factors (chapters 10 and 11): profile of each case - the meaning of the case, the formal organisation, what is aimed at, the market and industrial trend (particularly in the case of CDMA); the process that the roles and interests of players are reflected in the network design/ the shape of technology. The description of case studies is already organised to elucidate how those roles and interests penetrate the process of development and implementation.

Third, the interpretation of the sociotechnical process is integrated within the notion of 'governance' (chapter 12). I particularly extracted and addressed common themes of political embeddedness, global embeddedness and interaction with national power relations in each case. Several times of rewritings were conducted in this process and these rewriting again return to the understanding and presentation of the case studies.

2.6 Reflection

The most difficult and challenging point in my research process was the gradual refocusing from direct investigation of 'universal service' to unveiling how network design and technology development are being shaped. Whilst some interviews yielded opinions of players in the industry on the issue, people were hardly talking about universal service. It proved difficult to explore the context of universal service directly. Consequently, my empirical study approached the universal service issue in a rather implicit and indirect way, by exploring network design and technology development process per se. Universal service only became controversial when the competition fully began in 1996 in the Korean context, and then only in the matter of financial compensation occurring in access to Korea Telecom's network. I decided to focus on the process of building the two case studies but remained open to the issue of universal service.

The projects I explored were ongoing during my fieldwork period. On the one hand, I had the advantage of being able to access people and data without asking them to clear their cabinets; and, on the other hand, it was sometimes a hurdle that I had to get over, or which even constrained the research process in terms of the sensitivity of the secrets and interests of the players. The most critical phase in this problem occurred in the CDMA case. On the return visit, I found that there were a lot of things from my first visit that I could not catch up on because the development was 'successfully' completed at the end of 1995. I benefited a lot from the return visit. I almost dropped the CDMA case study from my research after the first visit as it did not seem to provide sufficient material on the interests of players and technological factors which were shaped by the players. It seemed that the first fieldwork period was badly timed for investigating the developmental process. The MIC was being heavily criticised about the development in terms of the time schedule and the appropriateness of the standard. The players involved in the development, especially in the MIC, were panicking and faced a critical phase of the developmental process in terms of reassessing aims and direction of the development (see sections 11.4.2 and 11.5.4). It was understandable that the first visit was not very successful because the development itself had not yet proven successful either. This stems from the fact that, in the Korean political culture, 'failure' is not acceptable and should not be exposed. I think that doing a case study is constrained by circumstantial factors in many ways, and it is equally critical that a researcher should be aware of the constraints, and should reflect on the extent to which the case studies are valid and reliable. In my case, by conducting two periods of fieldwork, the circumstantial constraints on the case studies were overcome so that I was able to meet my research aims and scope.

I was lucky to have an informal network which I could use for my data collection. I wondered whether it was rather facile to approach people whom I already knew. I believe the informal network helped in a way which enabled me to build up the interview network initially, as one contact quickly led to another. Moreover, the informal network helped in terms of refining research questions as well as providing substantial information. In short, my informants are positioned well enough that they would have been valuable to any researcher doing this research. In this sense, I prefer to feel fortunate to have had them as an informal resource than be concerned about convenient sampling.

Before going into the field, I was concerned about the fact that, in Korean culture, information is quite restricted to ordinary people, following the tradition of bureaucratic society. This was generated by the authoritarian regime which dominated Korean modern history for more than thirty years. I was actually faced with this on my first fieldwork in the case of CDMA. Before the developmental process was finished, I hardly got any substantial interviews as I mentioned before. Apart from that, I did not have much difficulty in approaching interviewees and getting informative and productive interviews despite my concerns.

As a woman researcher, I was also concerned about the situation of approaching mostly middle-aged and established male figures. I presumed that the fieldwork would be hard even for just 'getting the interview'. However, this did not appear to happen a lot. In general, in Korean culture, there is a rather contradictory attitude towards women. The position of women is generally not highly respected in the work place and family in terms of institutional support and emotional interaction. However, once people find the woman is professional, the attitude towards her becomes more supportive than towards a man. In fact, I am not really happy with this situation as I think this phenomenon also reflects people's prejudice towards women. After all, I am quite well aware of the fact that the presence of some professional women does not necessarily mean that the general status of women in society is improving. Anyway, being a professional woman helped with the fieldwork, and I was conscious of this in order to conduct the fieldwork successfully. This was actually only used for 'getting the interview'; I believe that, once I built up a trusting relationship with the interviewees, it did not any matter whether I was a woman researcher or a man.

Apart from the contradictory attitude towards women in society, being a woman sometimes helps to build up a trusting relationship even in the first encounter. There is clear sentiment towards women that they are pure and non political. As long as people give an impression that they are not harmful, once they build any kind of relationship, people tend to help more than is formally expected in Korean culture. Women are in a favourable position when they try to get help from people in this sense, because of the 'pure' image. This could exemplify the phenomenon that some women political leaders are respected and have authority in some oriental countries where the status of women is low compared with western society. I think this happens not because the general status of women in the society is one of respect, but because the people's sentiment is embedded in the situation where people respect and trust some selected women figures more than male figures.

I found that the interview process creates personal links as well as providing understanding and information on the inquiries during the process. In an interview lasting one or two hours, I found that interviewee and interviewer became friends who could talk about work and interests in a comfortable way. This did not happen all the time, but I felt deep gratitude towards the majority of people who gave their precious time and opinions with an open mind to a nameless researcher. I also learned how significant a researcher's personality is in the process of in-depth interviewing. The better I communicated with people, the more beneficial the interview results were. Being an untrained interviewer, I had to build up my tacit knowledge about how to interact with people. There were some situations where I wanted to interrupt the interviewees' self-satisfied stories, but I could not judge to what extent I should endure this and how I could approach this in a tactful way. I relied heavily on the interviewees' sensibility and generosity on these occasions. I believe I could have done better if I had had a chance to learn interview skills formally.

Linking research questions and analysis of the data I got from the fieldwork was not as easy as it seemed. Unveiling processes of technology development, in this case 'how' network design is actually shaped, becomes easier as the researcher gains knowledge and awareness of 'what' elements are involved. I developed an awareness to catch things and to give weight to certain points which I had not expected. It seems that the ongoing dialectics between 'how' and 'what' constantly developed throughout the research process. I developed my research questions in the early stages of the research, and the data collection and analysis were responding to my research questions. However, the fieldwork was a process of learning and elaborating my research questions more concretely. Inevitably, during the analysis stage, I had to accept some regrets about gaps in my awareness during the fieldwork period. For instance, I really wanted to go back and ask whether the technological task of the CDMA development was changed from what they originally wanted to achieve to what they can achieve (see section 11.5.4). This could be a crucial point given the particular political culture in Korean society, and I only realised it in the analysis stage.

The technology design process as a social phenomenon was far more complex than I had expected. When I encountered the 'sociotechnical' concept, I thought that I had always known what is 'social' and what constitutes 'technical'. When I actually organised and interpreted the data, the job was far more complicated. My awareness of the 'sociotechnical' has been developed constantly throughout the research process especially in the analysis stage when I started to understand the 'sociotechnical' as a 'process'.

It was an intellectual challenge to bridge between players identified in the case studies and macro and collective concepts such as state, capital, labour and civil society in political economy perspectives. The traditional sociological query about dichotomy between social agencies and social structure was to some extent repeated in the research process. It was rather exciting to see how the social agents identified located their interests within the broad political and economic macro categories. My job should not be just to present exciting evidence, but to try to make sense of the interests of individual social agents in the structure where they are placed and how the structure and agents are reshaping each other. Doing case studies and meeting these individuals expanded my awareness of the complexity of social phenomena, from the rather simple structure oriented perspective I possessed towards seeing dialectics between them.

In this stage of reflecting on my research process, I feel I have done not enough to make a linkage between my investigation of the shaping process of telecommunications network design and my attempt to establish political and institutional channels for realising public interests. I believe there is more to be said on the latter subject. I suspect my discontent arises from my structure oriented perspective in that I still do not quite believe that what I found through my research explains the theme in an adequately structured way. It might be that the research design I adopted does not quite meet what I wanted to establish as an aim. Since I reshaped my research focus from exploring universal service issue directly in the shaping process of network design to elucidating the shaping process per se, this was perhaps predictable. Nevertheless, I believe, I have shown a space where 'reshaping' could occur in this stage.

My research could have explored the discourses and policies of universal service linked to technological design process of network evolution in a specific phase of change. If I were to conduct a further project focusing on universal service, I would directly explore the following issues: how players in the telecommunications industry perceive 'universal service'; how their interests are permeated in reshaping the concept; how the 'sociotechnical' works in the reshaping process; and, how these are negotiated in the process of liberalisation. I would not choose Korea for this study. Instead, I would choose the United Kingdom or one of the Scandinavian countries, where the spirit of social equity has been institutionalised for longer, or the United States, where the actors in the industry are more diversified and a rich history of liberalisation of telecommunications is found, so that the negotiation processes are more visible and accessible.

PART II

LITERATURE REVIEW ON THE TRANSITION IN TELECOMMUNICATIONS

Chapter 3: Universal Service in The Transition

3.1 Introduction

'Universal service' has existed as an institutional commitment since the early history of telecommunications. The concept is not static but changeable and differs across specific social contexts. Telecommunications have configurational features constituted by dynamic technologies as well as by social institutions. After all, the concept of universal service is not a concrete legal commitment but is constructed as societies interpret their needs. There is no static definition, rather, the definition or the assumed contents of universal service itself represents societies' understanding of telecommunications and the orientation of related policies of it.

This chapter attempts to review ideas of 'universal service' in the telecommunications literature and policy implementations. This is an effort to establish a research focus on elements of the universal service concept in order to circumscribe the scope and scale of my research. All research on telecommunications policy is related to universal service concerns, directly or indirectly, because universal service is not a special element of telecommunications policy; rather, it is a basic assumption underpinning it.

This chapter looks at sociotechnical construction of universal service (3.2); discourses on universal service (3.3); the implementation of policies for universal Service (3.4); expanding the concept of universal service (3.5); and universality and network evolution as conclusion (3.6).

3.2 Sociotechnical Construction of Universal Service

There has never been a solitary definition of universal service. How universal service is defined reflects the interests of the players involved: "universal service is revealed as the stuff of myth, a slippery and ideological concept which has been used and manipulated by different parties to support their own case for special treatment" (Blackman, 1995: 171). The concept each society adopts at any one time reflects the stage of the network development and the different conditions of telecommunications each society has. It represents the consensus of social forces in the form of the regulatory regime: "universal service is the level of telecommunications service that public policy declared should be available to everyone at a reasonable cost - the minimum for equal participation in the economic, social, and political life of the nation" (Hadden, 1994: 48). The definition of universal service is a product of the goal of policy and the means of achieving it, in particular, in the conditions through which the electronic communications environment unfolds (Garnham and Mansell, 1991).

If we attempt to define universal service, however, we can suggest one guideline which should be decided by regulatory regimes or laws, and wider, society: the right of everyone to access to a telecommunications service. In the present transition in telecommunications, defining universal service per se is an attempt to establish a consensus about the extent of the liberalisation of telecommunications and the ways to protect public interests.

The origins of the universal service concept are found in the history of the telegraph and telephone as an innovation in the USA (Dordick, 1990). Dordick explores how 'universal service' became a corporate tradition in AT&T and a perceived consumer 'right' in US society. He finds the origins of universal service in the corporate strategy to establish a monopolistic system in which the Bell company could expand its services and facilities in a stable, standard and networking environment. The first general manager of the Bell system, Vail, recognised that a universally interconnected system would attract more subscribers, and that a single system using a single standard would be necessary (Dordick, 1990: 230).

> The Bell system was founded on the broad lines of 'One System', 'One Policy', 'Universal Service', on the idea that no aggregation of isolated independent systems not under common control, however well built or equipped, could give the country the service. One system with a common policy, common purpose and common action; comprehensive, universal, interdependent, and intercommunicating like the highway system of the country, extending from every door to every other door, affording electrical communication of every kind, from every one at every place to every one at every other place (Vail, AT&T Annual Report, 1910, quoted in Dordick, 1990).

Mueller (1993) supports Dordick's conclusions, suggesting that the ideology of universal service was far from pursuing social ubiquity in the modern sense, but meant an integrated monopoly that could interconnect all telephone users. However, his study goes further than

Dordick's, in tracing how the concept of universal service has been reconstructed through the history of telephony. The issues and emphasis surrounding universal service have changed, reflecting the different stages of development of telecommunications networks. In the beginning, universal service as a corporate strategy of AT&T meant connecting all subscribers to the same network with the emphasis on interconnection; this reflects the conditions of a telecommunications network which was unconnected. Once the network had stable nation-wide monopolistic features the emphasis changed to an issue of social justice; in the liberalised environment of today, the emphasis is now on how, and to what extent, new competitors compensate for access to public networks in the form of interconnection fees and a contribution to the costs of universal service. Mueller (1993) also finds that the concept of universal service is supported by political goals suitable to a particular system of economic organisation. "Widespread access to telephone service is seen as a policy goal of sufficient importance to justify rate subsidies, a legal obligation to serve, and other forms of government intervention in the industry" (1993: 353).

It is rather ironic that the concept of universal service derived from a corporate strategy in pursuit of a monopoly over an efficient network system. When the concept of universal service emerged, it was closer to efficiency concerns which justify the monopoly of the Bell system than to equity concerns. Universal service remains a major objective of telecommunications policy in the USA, despite the dramatic regulatory reforms taking place. Indeed, the discourses of universal service and the protection of public interests surrounded the divestiture of AT&T - which ironically had grown up in the very monopolistic environment, which had been justified by the need for an efficient networking system to promote public interests.

Network penetration is also focused in relation to how the emphasis on the universal service goal is changing (Blackman, 1995: Albery, 1995). Once a network is established, the emphasis shifts to technological solutions for linkage; as the network grows, the emphasis shifts to geographical availability; in the conditions of a mass market, the emphasis becomes economic in terms of rental charges and installation; and when the network reaches saturation, social goals and affordability become the focus of universal service

(Blackman, 1995: 172). This perspective seems determined by the technological conditions for universal service.

It seems that the strong linkage between monopoly and the sustainability of universal service is no longer convincing. "There is no contradiction between a competitive telecommunications market and the provision of an universal service with an affordable price to the customer" (Fischer, 1994: 135). Noam (1994a) suggests that competition, innovation and universal service could coexist; the question is how to allocate resources. Some research claims that liberalisation does not harm the traditional commitment to universal service by showing evidence of increasing penetration rates in the USA after the divestiture of AT&T (Dordick and Fife, 1991). This evidence, however, can be countered, if we reflect on changes in the concept of universal service. Hills (1989) indicates that the concept of universal service changed after the liberalisation of US telecommunications from its previous connotation of 'rights to usage' - which is based on equity concern - into an emphasis on changing penetration levels - which derives from the emphasis on efficiency (1989: 134). The evidence of penetration rate is, therefore, meaningful only in the efficiency concern.

Kelly (1994) even argues that the monopolistic provision of universal service early on in network evolution does not necessarily mean that universal service can only be achieved under monopoly conditions. Providing universal service is not an obligation at all but rather an opportunity and a privilege in that there is value just in having people connected to a network, in that uneconomic customers receive telephone calls from economic customers (Blackman, 1995: 173).

The concept of universal service has been constructed reflecting corporate strategy, telecommunications policy and network evolution. The history of telecommunications suggests that the concept of universal service changed from a means of justifying monopolistic provision to representing social justice, and the issue again has changed as it has arrived at the stage of liberalisation. The measure of universal service can be justified from both the equity concern and efficiency concern because universal service depends on how it is defined. The argument that universal service is now achieved in terms of penetration is problematic because universal service is an evolving concept reflecting how it is interpreted. The discussion of universal service is now beyond whether it goes along with the monopolistic provision.

Since the spirit of universal service in modern terms anyhow means protecting public interests, the logic of competition which undermines a monopolistic provision of telecommunications services should be differentiated from the issue of whether universal service goes with a particular form of service provision. Both the argument that monopolistic provision does not necessarily go with universal service in the historical sense and the issue of whether the modern conditions of networks require a change from monopoly into competition are still argued to sustain universal service as a policy goal.

3.3 Discourses on Universal Service

The universal service concept has been recognised in different ways and has existed in diverse institutional forms, depending on specific social contexts. The differing depths of emphasis, and the blurring and intermingling of concepts, comes from the fact that universal service is an ideological concept; it reflects the interests and rationales of the players in the sector. These problems of complexity have been observed by scholars and by policy and industry practitioners.

Garnham and Mansell (1991) explored different angles of the concept and of policy practices in European countries. They suggest the need to distinguish two approaches to 'universal service': politico-philosophical and economic. The former considers telecommunications access as a basic right of the citizen; the latter focuses on the aspects of the economic good related to the question of efficiency and the distribution of economic welfare. They also suggest that the goal of universal service and the means for achieving it need to be differentiated. Kelly (1994) follows this critique by saying that problems start when elements of the social/political and economic/legal definitions of universal service become mixed up (1994: 40). In the question of whether universal service should extend to sophisticated services available through newly developed networks, social and spatial equity arguments often blend with those about economic and regional development (Graham et al., 1996).

Unlike the North American tradition, in European telecommunications the concept of universal service is not explicit; rather, it has existed in the form of public service. If we discuss universal service in the context of liberalisation, the issue is associated with more practical legal and institutional issues; and the discussion of universal service needs to be distinguished from the concept of 'public service'(Garnham and Mansell, 1991). Furthermore, in terms of measurement problems, it is difficult to deal with universal service simply in the area of 'public service', in the sense that public service resides in the pursuit of normative social and political priorities which may over-ride strictly economic or technical criteria.

It is suggested that the political aspects of universal service are rooted in the nature of political systems and the potential use of telecommunications to achieve social integration. The telephone is essential "not only to keep in touch with the external world and for use in emergencies but also to foster community identification and participation" (Hudson, 1979, quoted in Hills, 1989: 135). Milne (1990) focuses on the affordability of the telephone and gives weight to the political will to achieve social goals. Schement (1995) finds that telephone penetration in the USA is directly correlated with income. He emphasises the political intention to achieve universal service;

> Universal service derives its significance from a promise rooted in the nature of the political system. All Americans are assured equal access to basic channels of communication because the citizens of a democracy need to be able to communicate in order to avail themselves of the information necessary to make reasoned political choices (Schement, 1995: 483).

Hills (1989) attempts to reconcile equity and efficiency considerations by framing the social justice and participatory rationale for cross-subsidisation in economic terms. She suggests that the efficiency consideration is not necessarily incompatible with social goals. She argues;

> Universal service, meaning the extension of the service to the whole of a geographical area, is not simply a question of benefits to all subscribers; there comes a point where, if access to a network is so expensive that it is limited to higher income earners or is

geographically restricted, then it ceases to be economically efficient as well as being politically divisive (Hills, 1989: 135).

It seems that, whereas the political aspects of universal service are discussed in terms of persuasion in achieving it, the economic aspects, in fact, comprise the level of practice. Even in its economic aspects, universal service still remains within the discourse of achieving social equity, and of the distribution of economic welfare. Hadden (1994) distinguishes 'fairness', which has a welfare component, from 'universality' which suggests a ubiquitous improvement of network functions (1994: 48).

Borrows et al (1994) distinguish the concept of 'basic universal service' and that of 'universal availability'. The former refers to the concept of being connected to the network and having some basic and defined set of services, while the latter refers to "the concept stressing the ubiquitous deployment of telecommunications capability with less emphasis on the actual utilisation of the services by all potential customers" (1994: 6). This division reflects a distinction between policy concerns about the social equity and economic development concerns about the network construction.

These aspects are realised in the form of regulation which is 'one in a set of political and economic processes and institutions available to government' (ITU, 1994). In this context, universal service is inherently a political concept. "Political and economic objectives are not always compatible, and regulatory authorities must function within their political context" (ITU, 1994: 63). The economic aspect of universal service is concerned mainly with how to realise universal service. The political aspect still matters not only in terms of political will but also in terms of political interests. Fischer (1994) admits that USO (universal service obligation) is a major subject of every political 'negotiation' as it has a strong political content and origin, so that the "best practice of USO must be politically convincing and respect the implication of political interests."

Universal service in policy concerns lies in political choice rather than simply being determined by technology. It seems that universal service concerns specific policy implementation associated with economic compensation and policy priorities embedded in specific forms in telecommunications. The normative persuasion towards meeting pubic interests should be differentiated from the practical side of universal service. Universal service is a concrete way to realise public interests supported by policy priorities rather than automatically accommodating the space and the process of change.

3.4 The Implementation of Policies for Universal Service

There are a number of sub-concepts to universal service reflected in the discourse. Garnham and Mansell (1991) suggest a way of defining and monitoring universal service in their classification under the following sub-concepts: universal geographical access; universal affordable access; universal service quality; and universal tariffs. The means of realising universal service are different from immediate goals. However, the idea of cross-subsidy is commonly acknowledged as means of achieving universal service; and has even become its synonym. Cross-subsidy issues are a substantial focus of policy considerations about universal service. These issues "arise from the fact that there are heavy infrastructural fixed costs involved in the establishment of the network, and that the network is utilised by a number of differentiated services" (Hills, 1989: 130). To sum up, who should pay for the existing network and the expansion of that network - governments, existing customers or future customers?

The issue of cross-subsidy has given rise to equity concerns in economics (Gillis et al, 1986). The questions are: does equity require that access be subsidised for all subscribers, as in current systems?; or does equity mean only that every subscriber has an equal opportunity to be subsidised, as with self-selection forms?; or, are the conditions of equity met if only low-income households receive an access price subsidy, as with forms involving means tests? (Gillis et al, 1986: 223).

Hills (1989) compares the concept in the context of the policy goals of the USA and the UK. In US tradition, the term is found to include both rights of access and rights of usage at reasonable cost. In the UK, the interpretation of universal service refers to relatively cheap access, uniform access rural and urban areas, cross-subsidised by trunk and international calls together with local measured service (1989: 131-132).

In the process of liberalisation, service classification based on the definition of universal service is adopted in the liberalisation policy. In liberalised market conditions, a common definition of universal service is essential for effective competition. Spaeth (1989) indicates that basic service and enhanced service received different regulatory treatment in the beginning of liberalisation. An enhanced service is a computer processing function which can be performed anywhere in the telecommunications network rather than at the site of a centrally located mainframe computer. This is the basis of competition among multiple service providers in the early stage of introducing competition. The concept of basic service is defined by technical criteria as those service elements upon which the delivery of other telecommunication services, variously designated as "enhanced", "value-added" or "telecommunication network-based", depend (Garnham and Mansell, 1991). This service classification is based on the concept of availability. Availability is often restricted to discussions on the dichotomy of basic service and enhanced service, and the former is often identified as a universal service.

Spaeth (1989) argues that the telecommunications industry must not be regulated by market forces, and that telecommunications companies should not be allowed to provide both basic and enhanced services as consumers can be harmed in circumstances where a company could impose the costs of enhanced service on basic service. One question that regulators face in relation to local exchange companies is whether the increased flexibility for telephone companies to invest and set rates undermines the universal service objective. Specifically, the major network investments that a local operating company must make to remain competitive with other service providers can result in increased rates for basic service even though consumers of basic services do not utilise the new services. Competitors worry that the local exchange companies can create an unfair advantage by using basic rates to subsidise investments for network modernisation and advanced services. On the other hand, decisions taken by regulators, with regard to rates and to determining the conditions of competitive markets, may promote a further bypassing of local exchange companies and may undermine the public network (Wilson and Teske, 1990: 167). The emergence of new competitors in local exchange service, Competitive Access Providers

(CAPs) who focus on the business market with high quality fibre optic networks, call attention to this issue (Gabel, 1995; Bernt et al, 1993; Kang, 1993).

Schement (1995) raises a point that goes beyond the cross-subsidy issue, suggesting that the definition of universal service should take into account the nature of demand in differentiating public needs from personal needs. "A universal service oriented in this way obliges government to meet the demands of the public sphere, while facilitating the opportunities inherent in the private sphere" (1995: 484). This is a rather different point of view of universal service in that it takes account of the demand side whereas existing concerns are heavily oriented to the supply side. Graham et al. (1996) conducted research which focused on the demand side of universal service, suggesting that concerns about universal service should broaden beyond a narrow focus on the regulation of the supply side. They point out that universal service remains just a 'good thing' whose meaning is rather vague and "has been socially constructed to mean different things at different places and times by supply side interests" (1996: 4), so that, "the wide social and economic benefits and externalities that accrue to society at large with the expansion of the telephone network need to be considered and explored" (1996: 10). They suggest that the issue of subscription and usage should be taken into account as universal service is a suitable policy goal to meet the interests of society (1996: 10).

Universal service has been pursued in the categories of universal geographical access; universal affordable access; universal service quality; and universal tariffs. Alongside these sub-concepts, the implementation of policies for universal service has been mainly focused on cross-subsidy issue, which pursues equity concerns in economics. In a liberalised market place, common definition of universal service has been suggested and implemented in policy realms for effective competition, which is mainly concerned with supply-side. The demand-side of universal service should be taken into account to realise public interests in telecommunications, which is relevant to expanding the concept of universal service. The next section looks at this aspect.

3.5 Expanding The Concept of Universal service

"Universal Service is a dynamic and evolving concept" (EC, 1996: 2).

Today, the issues about universal service largely reside in regulatory concerns. In particular, in relation to liberalisation and privatisation, universal service is often cited as a reason for sustaining the monopolistic public-owned telecommunications system. The regulatory reforms in telecommunications have been interwoven with the technology available and with the debate between equity and efficiency in the process of liberalisation and privatisation. The questions as to what universal service means and whether the concept should be abandoned or redefined are directly related to the questions of how far liberalisation goes and how to sustain public interests in the course of this change.

Some scholars suggest ways of expanding universal service in multimedia usage. Hadden (1994) suggests a way to expand the concept of universality within future networks by realising connectivity; features of networks; switching and broad-bandwidth; openness; interoperability; accessibility; usability; information service; and privacy and security. "Targeting the concept of universal service, therefore, only to disadvantaged consumers and to high cost and rural areas is too narrow a view of universal service to serve the multimedia needs of all Americans" (Jones, 1994: 102).

Then, what is actually happening to the issue of expanding universal service? The answer is that universal service is still confined to basic telephony whereas most practitioners admit the concept should be expanded in the future. An OECD report finds that most OECD governments have not addressed the issue in detail whereas they do recognise the significance in the information society of ensuring the availability of information infrastructures to all at affordable prices (OECD, 1996:10). The report suggests the significance of dynamic adjustment for universal service for future technological development. *"Policy makers need to ensure that regulations clearly specify that the concepts of universal access and universal service will be subject to modification and adjustment as information infrastructures expand and develop, thus maintaining the option to review universal service concept"* (OECD, 1996: 14, emphasis in original).

The EC conducted a survey of the level of service quality in the Member States and of public consultation on the universal service issue. In the USA, a similar survey was carried out (Borrows et al., 1994). This found that universal service is generally supported as a principle within the telephone service whereas the debates about what telecommunication services are sufficient to constitute 'adequate' service remain unresolved. These reports are interesting as they reveal through the survey how the concept of universal service in the policy realm is actually working for attaining it. The EC report identifies five main issues and suggests consultation as follows: the scope of the universal telephone service; the quality of service and comparability of service at a European level; the costing and funding of the universal telephone service; tariff rebalancing; and public access to the information society (EC, 1996).

In the report, the scope of universal service is currently defined as:

> the provision of voice telephony service via a fixed connection which will also allow a fax and a modem to operate, as well as the provision of operator assistance, emergency and directory enquiry services (including the provision of subscriber directories) and the provision of public payphones (EC, 1996: 6).

The EC does not offer a broader definition of universal service because the scope of the universal service obligation should represent a delicate balance between the concern of citizens' participation and new players' market entrance (EC, 1996: 11). However, the EC report still stresses:

> user demand and technological evolution must be the principal determinants of the future evolution of universal service ... extension is therefore likely to combine a market-based analysis of the demand for, and widespread availability of, a particular service, and a political assessment of its social and economic desirability (EC, 1996: 26).

In the USA, the universal service policy looks beyond a basic definition of universal service towards 'public access' for schools, healthcare and libraries as one of the principles for advancement of a universal service. The Federal Communications Commission (FCC)'s principles on universal service are: quality and rates; access to advanced services; access in rural and high-cost areas; equitable and non-discriminatory contributions; specific and predictable support mechanisms; access to advanced telecommunications services for schools, health care, and libraries; additional principles[4] (FCC, 1996: 4). In contrast, in the case of the EC, the regulatory approach to universal service for telecommunications is circumscribed by the application of the principle of subsidiarity.

Expanding the concept of universal service is closely related to how to deploy liberalisation policy. Current questions about universal service enter the debate on whether its definition is circumscribed within service provision or whether it should embrace the level of technology available. In Europe, it is currently confined to basic telephony while in the USA, it goes further towards public access of the telecommunications services. It seems that the USA attempts to resolve the issue in a way which pursues liberalisation on the one hand, and one the other put the universal service policy into the construction of NII (National Information Infrastructure) (see section 4.3) and its public use.

3.6 Conclusions: Universality and Network Evolution

We have seen how the concept of universal service is constructed by sociotechnical dynamics which embody policy discourses and concerns as well as under changes in telecommunications technology and institutions. These dynamics are currently attracting considerable political attention but rather a narrow range of practical suggestions. My research focuses on the relationship between the technology developments embedded in the telecommunications infrastructure and the social contexts which shape it.

Some research is available which has attempted to bridge technological innovation and universal service, suggesting that how to achieve universal service depends on the network conditions each country has. Tyler et al. (1995) suggest that achieved levels of universal service are influenced in part by technological innovations. "Innovation in telecommunications services affects the ways individuals and households organise their lives, and the ways government and business conduct their activities. This can and does change which telecommunication service or service features are considered 'essential'"(1995: 19). The ways to achieve universal service vary in many countries

[4]That is, such other principles as the Joint Board and the Commission determine are necessary and appropriate for the protection of the public interest, convenience, and necessity and are consistent with the Telecommunications Act of 1996.

reflecting their political and economic circumstances. In most developing countries and NICs, achieving universal service goals could mean to meet the demand for access lines which exceeds the supply (1995: 4). This research can be appreciated in terms of how it presents empirical evidence of the significance of innovation to realising universal service, and of how it recognises divergent social and economic contexts. However, it still looks at the issue as if it were a linear causal relationship between technological factors in the network conditions and achieving universal service. Technological innovation certainly helped in meeting unsatisfied demand for access lines. It was necessary but not sufficient for achieving universal service. We need to expand the issue to a dynamic process of network deployment including political contexts.

Some discussion of telecommunications which deals with equity considerations of telecommunications seems to be useful to expand our perspectives. Grandy indicates that most information systems are designed to meet the needs of the upper classes; those without the background knowledge which is provided by education or participation in an information-rich network, simply fail to absorb the benefits of information (1986: 11); "This inequality is reinforced or exacerbated by differential access to quality education, and is maintained by class-dominated networks of mutually reinforcing information exchange" (1986: 12).

The notion of class-shaped network and service provision should be expanded in the realm of the current exploitation of new technologies and services. The newly emerging services which are available in a liberalising environment are constructed in a way which reflects the interests of social forces involving inclusion and exclusion.

> The availability of services, both in the sphere of information and entertainment, is further constrained by the intrusion of the market and the consequent weakening of commitments to public service in broadcasting and to universal access in telecommunications. While societies as a whole become progressively more dependent on electronic media and information and communication services, then those who find access, for financial or other reasons, increasingly difficult or just simply impossible will become progressively marginalised and excluded (Mansell and Silverstone, 1996:224).

Since universal service depends on what kind of political choices are made, we need to look at elements of political choice towards meeting public consumption. Hudson (1994a) approaches universal service in the context of developmental concerns. She suggests that the basic social welfare problems in US society can be resolved with a solid policy for realising universal access in the information society. The underlying rationale is that universal access to information is critical to the social development process (1994a: 663). She suggests that we need to broaden our definition of universal service from individual access to encompass services that telecommunications can deliver to individual residents through community or institutional access sites; "the definition of 'public interest' beyond the simple assessment of connection to the network and pricing of basic services" (1994a: 666). With this argument, she emphasises the role of government in 'shaping and articulating a national vision' of telecommunications development (1994: 82). In her attempt to reconcile the conflict between equity and efficiency concerns, Hills (1988) also locates universal service in the context of development (see section 3.3). She relates universal service to long-term efficiency concerns, meaning that universal service contributes to sustaining economic efficiency, efficient communication systems, as well as improving social integrity politically.

Expanding the concept of universal service is a consensus-building process, reflecting players' interests - rather than being determined by the technology available. In a situation where regulation and service provision is simply divided between the regulator and public monopoly provision by PTO, universal service coexists with public monopoly as both a duty and a privilege simultaneously. As we have seen in the case of the EC and FCC, they at least are attempting to build a consensus in terms of effective competition and efficiency. Under competition, the consensus-building process between players is more complicated; after all, public institutions can play a role in guiding consensus concerning an economic rationale and the technology available. This process is far more political in the sense that a political will and consensus are essential among the variety of players.

The issues of universal service largely reside in practical regulatory concerns, and the technological elements do not directly suggest the appropriate policy. I have chosen to focus on the political aspects of universal service, rather than on the technical details of its implementation. Policy is a political choice rather than simply being determined by technology. While the focus on regulation and technical assessment in universal service attempts to articulate technical elements and economic calculation, I would like to focus on the context and process of consensus-building associated with power relations and with technology by examining network evolution as a design process. In the process of introducing newly developed technology to the telecommunications infrastructure, I will look at the choice of relations (e.g. the introduction of competition), the relationship with the public, and the process of reflecting interests of social forces.

I also focus on the aspect of 'universality': the process of building a telecommunications network, rather than on the aspect of usage within the context of universal service. That aspect of 'universality' still embraces 'fairness' in the process of building networks. The issue of universal service will be adopted as a reference to access broadly how public interests become embedded in the network design.

The next chapters in Part II look at those issues which become pertinent when we focus on the network design process.

Chapter 4: Telecommunications Network Evolution: Technologies and Institutions

4.1 Introduction

Moving on now to the question of telecommunications network evolution, I shall explore technological change and the social and economic interests of telecommunications in the light of the conflict between 'public service' and 'strategic industry'. Those issues will lead us to the point of establishing a perspective on telecommunications and will confine the questions raised in this thesis. This research begins with critiquing the existing concerns in telecommunications research mainly focused on technological possibilities and their diffusion in looking at the transition of telecommunications, by recognising that the development of telecommunications in fact involves political and economic interests.

This chapter examines the characteristics of telecommunications and the changes in telecommunications by looking at telecommunications as infrastructure (4.2); network evolution as design (4.3); regulation and the role of public policy (4.4).

4.2 Telecommunications as Infrastructure

Seeking out the social and economic implications of the development and implementation of advanced network infrastructures is to question how the process is being shaped and reproduced in the relationship between production and consumption. "There are tensions at the interface between production and consumption of telematics services that shape the design of networks" (Mansell, 1996: 23). This section looks at the characteristics of telecommunications as infrastructure in order to identify how this nature of telecommunications is reinterpreted in the transition of telecommunications reflecting the relationship between production and consumption.

The dialectic of technological development and social dynamics is being shaped and constrained by technologies, users and producers. In particular, telecommunications has been regarded as 'public service' and 'infrastructure', so that the state apparatus plays a role in pursuing public interests in the form of regulation. The sector is changing from being organised in the public domain into a profit-making industry. How telecommunications is changing from public infrastructure into a profit-making industry involves political and economic interests of participants. This change emerges from the characteristics of telecommunications which is identified both as a public service and as an industry.

> The legacies of historical investment in infrastructure and the interests of those who stand to gain financially from these markets create biases in the trajectories of technical and institutional change. Information and communication technologies are no different from other technologies in this respect (Mansell, 1996: 37).

Telecommunications as infrastructure includes two aspects: telecommunications development contributes to overall economic development on the one hand and, on the other, to an infrastructure for the telecommunications industry per se. Telecommunications as a public sector enterprise was sustained by the assumption that the telecommunications infrastructure serves broad public interests by promoting development of the economy at large with inherent externalities (Scherer, 1994: 72). The aspect of infrastructure in fact sustains the involvement of the public sector in the telecommunications industry, even in a liberalised environment; "for a variety of reasons ranging from the high capital cost to the fundamental economic and social importance of the sector as one of society's infrastructures, telecommunications is too important to rely on market or private forces" (Schultz, 1994: 475). The national telecommunications network infrastructure, at least, is considered to require protection which can only be offered by the public domain. (Collings, 1994: 567).

Whilst this discussion emphasises the public significance for social and economic development of telecommunications as infrastructure, telecommunications is suggested by scholars and policy practitioners to be a 'strategic industry' (Harris, 1988; 1990). The term 'strategic industry' is similar to 'leading industries', in Schumpeterian terms, and is defined as an engine of economic growth and technical progress. A 'strategic industry' is based on the concept of 'social overhead capital (SOC)'- infrastructural industries that (i) provide services that are basic to a great variety of economic activities; (ii) exhibit a high degree of 'publicness' (and are therefore usually provided by public agencies or private firms under public control); (iii) are immobile, and therefore cannot be imported; (iv) have substantial 'lumpiness' or technical indivisibilities; and (v) have very high capital/output ratios, with large fixed investment required to achieve an economically viable level of output.

Investment in social overhead capital, therefore, is not only essential but also requires a national strategy for its economic development (Harris, 1990: 100). With this characteristics, it is argued that the policy should take into account the effect of it in both economic and developmental senses. This concept in fact works in favour of competition and deregulation, which embraces "an affirmative telecommunications policy that will provide enterprises the freedom, the flexibility, the incentives and rewards to meet business and consumer demands for communications and information services" (Harris, 1988: 44). The point of telecommunications being seen as a strategic industry is that a strategic industry carries notions of meeting national interests. As both the USA and the UK have articulated it, the liberalisation and deregulation of the last decade is based on a belief in the dominance of information technology and its use for national industrial policy.

The prerequisite of deregulation, however, is still problematic. Garnham (1994) points out that there has been massive and increasing divergence and that, even as late as the 1970s, the communication devices and networks used by the average home and business still relied on the post and the telephone. He argues that telecommunications policy over the last decade can be read as;

> an attempt to pretend that this divergence has not yet taken place and that the majority will benefit from, and may even be persuaded to pay for, innovations designed to benefit the major corporate users, for instance both ISDN and broad band networks: and a supply-driven policy of technologies, publicly supported for industrial policy reasons, in search of consumers who never materialised (Garnham, 1994: 47).

The deregulation deployed over the last decade is simply seen as an attempt to camouflage the intensified divergence between business and residential use of telecommunications services. In addition, policy in the USA and the UK is encouraging the development of sophisticated functions and network performance. And other parts of the world certainly fear that they could lag behind if they fail to transform their market structures and regulatory schemes to meet the pressures imposed by a new world trade order (see section 4.2).

The discourse of national interests includes the role of telecommunications in technology development, which used to be based on the tied relationship between the PTOs and domestic manufacturers.[5] PTOs were traditionally given a role in national technology development by funding and procurement, which is set within national industrial development policies: "These industrial policies tended to support the establishment of "national champion" electronics firms and implicitly assured them major shares of public procurement contracts at prices that often shared in the monopoly profits of the operator" (Noam and Kramer, 1994: 282). In some countries, the PTOs integrated vertically into the manufacturing of telecommunications equipment.

This industrial policy aspect of innovation in telecommunications stems from the characteristics of 'network'. Antonelli (1993) looks at the particularity of technological innovation within telecommunications;

> The diffusion of technological innovations within the telecommunications network acted as a dynamic factor which modified the given set of inter-dependent relations between specialised activities. In this respect the diffusion of innovation revealed 'strong dynamic externalities' and increasing returns which constitutes and continue to constitute the engine of growth of this industry (Antonelli, 1993:195).

The innovation activities in telecommunications are more significant and influential than in the other industries because of the 'strong dynamic externalities'.

Then, facing competition, how do the PTOs actually perform R&D activities? If there is a changing feature, how does the change affect the public role of R&D? Here, can we assume that the R&D activities of PTOs facing competition are likely to be directed towards the market rather than towards public interests?; if so, how? Harris (1990a) explores the changing features of R&D activities within the Bell system, pointing to the disadvantage of

[5] "This pattern of R&D co-operation has many facets: joint R&D subsidiaries controlled by carriers and manufacturers; R&D commissions awarded to manufacturers by carriers, whereby the manufacturers are permitted to exploit the know-how obtained by these means on other markets at little or no cost; co-operative R&D projects involving carriers and manufacturers which envisage know-how transfer and shared R&D expenditure; commissioned pilot schemes conducted by carriers with manufacturers; joint working parties to determine new system specifications; and patent exchange agreements" (Grupp and Schnoring, 1992: 48).

these R&D activities, i.e. causing a reduction of national innovative competence in the telecommunications field. This originated from the inefficiency of organising R&D activities following the divestiture of the monopolistic power of the Bell system and of the regulatory prohibition in the RBOCs 'business areas'.[6] He suggests that the removal of restrictions would certainly generate a much higher level of joint R&D and other forms of joint ventures and collaboration between RBOCs and telecommunications equipment manufacturers. He concludes that little thought was given to these dynamic technological considerations in the MFJ decision and in concomitant public policy debates. Harris' analysis approves the removal of business restrictions on the BOCs, in order to encourage R&D activities in the field of enhanced information services and manufacturing areas, giving the role of managing national resources to Bellcore. He recognises the role of favoured procurement by PTOs in dynamic technological development, in the sense that the users (PTOs) of the telecommunications equipment are large enough to determine technological development. Noll (1991) goes a step further in debating concerns about national resources for R&D following the divestiture of AT&T. He suggests that it is rather irrational to locate Bell labs as national R&D resources in a liberalised environment. He argues therefore, that a new entity which provides national R&D is needed.

The strategic industry aspect of telecommunications has reinforced the attractiveness of liberalisation. This is, ironically supported by the sector's public significance, which is represented by the notion of national interests and by technological externalities.

---

[6]RBOCs (Regional Bell Operating Companies: Regional Holding Companies) that have been providing local telephone service since divestiture of the Bell system used to be prohibited from providing some business areas until Telecommunications Act 1996. These business areas were reviewed every three years, in confirmity with the MFJ (Modified Final Judgement: the judgement of AT&T divestiture that constitutes juridical regulation). At the beginning of the divestiture of the Bell system, RBOCs were prohibited from providing long-distance services, leaving AT&T Communications with the right of providing long-distance services, non-telecommunications services and information services and manufacturing equipment. At the first review (1987), RBOCs were allowed to provide non-telecommunications services and information services only in transmission. At the second review (1991), RBOCs were allowed to provide information services not only in transmission, decided at the first review, but also to offer information service contents. RBOCs had been only prohibited from manufacturing equipment and providing long distance services until 1996. After the MFJ, RBOCs tried to expand their business areas through lobbying in parliament. Recently, through the emergence of PCS (personal communications services) and CATV, etc., the tidy classification of services has collapsed, and through the emergence of CAPs (competitive access providers: local telephone service providers who compete with BOCs), and the need to invest in fibre optic cable etc., the question that the prohibition of services could reduce national competitiveness has been raised in places.
Harris's article was written in 1990, when information services were prohibited. His article shows the problematic condition of regulation, representing the opinion of people who approve the deregulation of RBOCs through aspects of their R&D activities.

Telecommunications is a sector which by its very nature imposes a significant industrial policy-making role on public institutions. This aspect coexists with the emphasis on public service aspects of telecommunications. Today's telecommunications, however, give more weight to industrial policy.

The technological nature of telecommunications network is changing; we look at these developments in the next section.

4.3 Network Evolution as Design

The technological trajectory of telecommunications is being socially constructed in the form of a design, which "embodies the traits of intentionality and purpose and, therefore, of the capability to initiate, as well as to constrain, action" (Mansell, 1996: 23). Telecommunications technology is being shaped by the relevant players and institutions. In this section, I look at the major changes to network features which reflect and interact with the interests of the relevant players in order to understand network evolution as a design process.

The fundamental changes taking place in telecommunications networks can be traced to the increasing power of computers within the network infrastructure. Computerisation allows for a divergence of the network beyond a single PSTN (Public Switched Telecommunications Network) with decentralised processing capabilities. Networks are diverging from one simple public network into several entities which are distinct from the public network. Some utilise the infrastructure of the public network in the form of leased lines. Others such as satellites, radio transmitters, and cable networks are being constructed partly, or entirely independently from the existing public network (Pogorel, 1994). Electronic switching functions, supported by software capability, places intelligence in the network and in decentralised network functions. The network is expanding beyond the existing hierarchical pyramid structure into a decentralised structure, called a 'geodesic network' (Huber, 1987; 1991).

The development of private telecommunications systems have benefited from advances in switching and transmission technologies, called VPN (Virtual Private Network) which are provided by public telecommunications operators. Alternative Local Providers (ALPs) or Competitive Access Providers (CAPs) have emerged which bypass the existing PTOs' facilities using advanced fibre-optic technology in US telecommunications. The emergence of fixed radio technology has brought new features to local exchange networks,[7] which can substitute for the monopoly of existing local telephone network at low costs. Introducing competition within local telephony can promote improvements in access networks.

Network digitalisation, regarded as a radical innovation some fifty years after the electromechanical revolution in telecommunications, facilitates network switching, transmission and terminal equipment. With digitalisation, the public telephone networks are becoming computer-intensive with more capacity and flexibility. Computerised switching systems augment the significance of software in the introduction of new services (Wilson and Teske, 1990: 159). Mansell (1993a) sees Intelligent Network (IN),[8] driven by digitalisation and computerisation, and software-intensive network functions as a turning point in network evolution - accompanying technical and institutional innovations, rather than simply representing the latest in a series of innovative engineering developments (1993a: 19).

Harrison (1993) observes that intelligent network service developments support a market orientation. Hence there are efforts to establish a basic set of common services which are offered by all operators. Many operators, particularly in the USA, are seeking to maximise their competitive advantage and profitability by tailoring services to suit individual customers (Harrison, 1993: 31). The market-oriented nature of Intelligent Network involves 'universality' in designing process (Fujioka et al., 1991). Universality is suggested

[7] In the UK, the 3rd licensed basic telephone network operator, 'Ionica', launched their telephone service in May 1996 with fixed radio technology, declaring it would compete with BT on a cost basis.

[8] Initially, the intelligent network used to be presented as a technical solution to problems of service control, being associated with freephone services, virtual private networks, credit card validation, universal access numbers and call-back-when free services in the US Bellcore's objectives for the intelligent network were described as falling into three categories: the development of a flexible network architecture, the implementation of standard network interfaces, and increased speed in advanced service introduction (Mansell, 1993a: 20).

as a form of provision mechanism through which any kind of service demanded by customers can be realised. The evolution of the intelligent network is an evolutionary process in service capability, meaning that service customisation is essential. In an Intelligent Network architecture, "the network as a whole is coming to be something like a computer for which the customer or network providers could make programs in a fairly short time and load them onto it for execution when requested" (Fujioka et al., 1991: 45). In particular, with the introduction of ISDN and the provision of digital data services in unified networks, service capabilities, including those of a non-telephone-oriented nature, will be better verified with an IN architecture.

In addition, ATM (Asynchronous Transfer Mode) technology adapted for public networks is likely to transform the telephone network into a service-independent communications platform, as "it is a technology designed specifically to address the convergence of modes and has accordingly been slated for use as a vehicle to deliver a broad range of services" (Downs, 1994: 114). Downs (1994) examines the implications of ATM technology in future telecommunications networks, and argues that ATM technology was chosen by Consultative Committee for International Telegraph and Telephone (CCITT) for its flexibility, and represents an attempt to generalise the functionality of the network. ATM's flexibility comes from its fundamental indifference to the applications it supports. Currently ATM is being installed in customers' premises, not in public networks. The service-independent nature of the networks adopting ATM technology will require a shift of role for network operators from one of delivering specific services, such as telephony and CATV, into one of providing "more fundamental communications building blocks" (1994: 121).

The shifting role of network operators in ATM-based networks in accordance with an intelligent network raises a fundamental policy question in that it implies different telecommunication development strategies for network operators, equipment suppliers, service users and regulators. If we look at the relationship between carriers and manufacturers, the traditional tie between them becomes loose as computer capability becomes more significant than network capability. For firms in the computing and software services industry, the intelligent network is a way of encouraging a multi-vendor environment and creating opportunities for increased sales of hardware and software needed to complete the transition to a fully intelligent public (or private) network infrastructure (Mansell, 1993a: 30). This phenomenon reflects the changing technological environment and the changing function of players in telecommunications, which respond to the former. In consequence, the design process of networks has become more complicated, compared with the previous situation where PTOs' intentions could be implemented in a straightforward way (Mansell, 1993a).

Mansell (1993a), nevertheless, emphasises the uncertainty surrounding modifications in the basic network architecture at the implementation stage and its implications for suppliers in the telecommunications and computing industries, and the uncertainty surrounding changes in the terms and conditions of access to public and private networks (1993a: 20). She shows how design parameters affect the terms and conditions of network access and, ultimately, of participation in the networked economy. She argues that if policy and regulation are to encourage more equitable access to electronic means of communication, the social and economic issues raised by the technical design and implementation of the intelligent network must be addressed by a community far wider than the network engineers.

In addition to digitalisation of networks and software-intensive network functions in fixed telecommunications networks, rapid diffusion and recent technological developments in the mobile communications area[9] are changing the network paradigm through the concept of Universal Personal Telecommunications (UPT). The network paradigm may change in a situation where network planners are beginning to incorporate a 'mobility imperative' into the design of the basic user interface with the network.

> If universally applied, this imperative essentially would change the overall network paradigm from one in which the user has to 'find the network', that is, physically to locate a network node in order to gain access to the system, to one in which the onus

[9]The mobile communications infrastructure is gaining a high profile in the market. Mobile communications have gone beyond analogue-based service provision and are in the process of introducing digital cellular services which provide improved signal quality, security, and use of spectrum. All European countries and many elsewhere in the world, use the GSM standard for digital cellular radio networks which operates at 900MHz, and in some cases also use DCS1800, a variation of GSM for use at 1800MHz. GSM was specially developed, with the encouragement of the European Commission, to provide the countries of Europe with a mobile radio system set to a single standard which would allow users to roam freely from country to country, without interruption of the service. The US and Japan use different standards. With the introduction of digital services, all countries have introduced competition (Harrison, 1993).

is on the network and service providers to 'find the user' wherever he or she may be located (Hawkins, 1996: 172).

Today's pervasive design efforts in the telecommunications infrastructure are found in national initiatives for constructing broad-band ISDN and integrating networks, thanks to ubiquitous digitalisation and intelligent network functions. "Many of the visions of the future information 'highways' foresee the ultimate integration of all these networks to forge a virtual 'system of systems' that will become pervasive in the social and economic order of the twenty-first century" (Mansell, 1996: 36). The extent of digitalisation is a useful measure of the capability of a network infrastructure.[10] The provision of broad-band network capability focuses on the deployment of optical fibre cable coupled with electronic systems. The provision of a broad-band telecommunications infrastructure is seen as a necessary prerequisite for the development and use of many networked multimedia applications.

The USA is pursuing its National Information Infrastructure (NII),[11] which has its core function in the National Research and Education Network (NREN). The US Government has considerably modified its original thinking on the role of government. The Government restricted its role to co-ordination, regulation, tax incentives and the funding of selected applications and demonstrations in the public sector, leaving industry to build the network.

---

[10] "Digital telecommunications systems for telecommunications operators were designed primarily for the transmission of traditional telephony traffic, and have therefore been based on a bit rate of 64 bit/s, originally chosen to allow satisfactory voice transmission over several digital links in tandem. The use of this rate has allowed operators to offer new services to users, including the transmission of data at higher bit rates, digital leased lines at multiples of 64 bit/s, and ISDN. To measure the extent of digitalisation, the elements of digital equipment, and subscribers' connection to digital exchange are main factors" (Harrison, 1993: 21).

[11] The nine principles of NII are:
(i) Promote private sector investment
(ii) Extend the 'Universal Service' concept to ensure that information resources are available to all at affordable prices
(iii) Act as a catalyst to promote technological innovation and new applications
(iv) Promote seamless, interactive, user-driven operation of the NII
(v) Ensure information security and network reliability
(vi) Improve management of the radio frequency spectrum
(vii) Protect intellectual property rights
(viii) Co-ordinate with other levels of government and with other Nations
(ix) Provide access to government information and improve government procurement
- special commitment: the US government to implement new legislation to increase competition , particularly in cable TV and local telephone networks, before the end of 1994 (The Information Industry Task Force, 1993).

In Japan, the government agency, Ministry of Post and Telecommunications (MPT), is closely involved in establishing a framework for introducing a new broad-band infrastructure, which it believes will benefit the community at large, as well as business users. It believes that both the private and public sector should be involved in its development. Japan established its 'Law of the Enhancement of Telecommunications' in 1991 for the national initiative on the telecommunications infrastructure, with the Association for the Promotion of New Generation of Network Services for the key telecommunications players, and the BBCC (The Association for Broad band Business Chance and Culture Creation) comprising 150 major Japanese corporations from all market sectors (Harrison, 1993: 14).

The creation of the GII (Global Information Infrastructure) ultimately implies a global 'virtual' marketplace for information and telecommunications services, entailing a substantial upgrading[12] of the present telecommunications networks (David and Steinmueller, 1996). The significance of inter-operability in terms of standards is suggested since "the GII fabric is not being woven anew, but instead must be sewn together from existing national telecommunications infrastructures that are largely based on voice telephony, which are individually undergoing upgrading as a result of national initiatives to extend advanced telecommunications technologies and services" (David and Steinmueller, 1996: 7). The national initiatives of information super-highway is undergone eventually to meet the need for initiatives of a global virtual market place which GII implies.

Although these plans are less substantial in practice than it is commonly acknowledged, they certainly raise the issue of investment in telecommunications broad-band infrastructure. How those services which have become available from technological solutions and from investment in infrastructures are deployed is a different concern to that

[12]This upgrading has three main features. First, it will make it possible to deliver new services that require substantially greater bandwidth (i.e. broad-band services) than either the traditional reference standard of plain old telephone service, or basic rate ISDN. Such services includes video on demand, interactive video, and video telephony. Second, it will support growing use of inter-networked data communications such as are offered by Internet as well as new generations of value-added network services for users of computers and other networked digital equipment. These services include business, residential, and public sector 'tele-activities' - for example, tele-working, remote learning, tele-shopping, and tele-medicine. Third, the upgrading of the network is linked to the policy aims of enhancing and accelerating the prospects for competitive entry in all facets of the telecommunications industry (David and Steinmueller, 1996).

of general investment. The deployment of new technologies and services depends on the access network rather than the exchange system. Telecommunications Operators (TOs) have invested extensively in broad-band equipment for their interexchange networks in order to achieve improvements in capacity and quality, and to reduce operating costs.

> The operational savings allow ready recovery of the capital investment. However the decision to invest in broad band infrastructure in the access network is heavily dependent in the forecast level of traffic generated by the users. As a consequence, the approaches being taken for heavy business users differ from those being taken for residential and small business users (Harrison, 1993: 35).

National initiatives on telecommunications infrastructure are being built with an emphasis on industrial policy from the aspect of the infrastructure of telecommunications and, at the same time, inducements for private capital to invest in infrastructural development by liberalising the industry. Technological changes are bringing more flexibility and capacity in responding to service applications in today's network feature. These technologies, however, are deployed and implemented by design. The industrial aspect of telecommunications is prominent in today's network evolution and national initiatives on telecommunications infrastructure can be seen as an embodiment of this respect. The transition of telecommunications reflects this changing emphasis. The question as to how the public characteristics of telecommunications can be sustained still remain. The next section examines the policy realm in this changing emphasis.

4.4 Regulation and the Role of Public Policy

Regulation in telecommunications articulates an explicit political consensus. "Regulation is neither neutral, impartial, nor even non-political. Regulation in North America, to paraphrase von Clausewitz, has always been "politics by other means"" (Schultz, 1994: 476). In the first place, because of the sector's public characteristics, regulation has been regarded as a controlling system over the industry. Because of the changing emphasis of the industry, regulation is now seen to require a more complicated role.

Schultz (1994) sees the role of regulation as a regime of social control, based on public ownership and distinguished from the market. "Public ownership entails public, centralised, compulsory relations directed by the state, which determines the production of goods and services, the prices to be charged, and the quality of the specific transactions" (1994: 474). Regulation of telecommunications has been employed for more than economic reasons; "Regulation in effect became the instrument for the taxation of some subscribers in order to confer benefits to others"(1994: 475). This perspective offers the extensive role of regulation in realising social equity in telecommunications.

The nature of regulation as social policy need to be examined in a liberalising market. The manner of consuming telecommunications services changes in a market environment; "subscribers become customers"(Blackman, 1995). Accordingly, regulation is required to protect minimum consumers' rights in the market, rather than to protect ubiquitous public consumption. Noll (1994) argues that regulation should be scrutinised so as to reveal where the benefits from the introduction of competition actually accrue, rather than assuming that competition cuts the price of services and therefore brings benefits to consumers. He has examined price rates after the divestiture of AT&T, and finds that neither competition nor divestiture has had any real effect on long-distance rates; these have been decreasing because of technological innovations and increases in productivity, coupled with increases in market demand.

In a liberalising environment, regulation has come to acquire more positive roles. Miller (1994) sees that the role of regulation in 'effective competition' is to ensure that the new structure achieves the purposes intended by the government. He emphasises the role of public organisations by pointing out;

> an active public role in the telecommunications sector should in fact be a central element of any reform effort if the overriding objectives of economic development and social justice are to be maintained. The key is to define the appropriate parameters of public versus private responsibility (Miller, 1994: 506).

In the objectives of social equity and long-run economic gains, which are possibly ignored by private monopoly, public institutions should actively play a regulatory role. As to the industrial aspect, the role of regulation is emphasised as ensuring the economic performance of telecommunications restructuring (Sherer, 1994: 76).

The national initiatives for an information infrastructure reflect developmental concerns in telecommunications. The government is not simply seen as a regulator, but as a developer and promoter of policies and investment efforts. In the NII project, the roles of government are presented:

> first, in the policy arena, government can act to remove roadblocks to the implementation of the NII by devising policies that enable the development of a coherent infrastructure while allowing competitive market forces to drive the creation and selection of products that make up the infrastructure and its associated applications; second, as a large user and provider of information, government can act as an early adopter and a role model to accelerate the widespread use of NII applications and services; third, as a partner with industry and academia, government can foster and support a long-range research programme to address many technical problems that are key to the success of the NII (Technology Policy Working Group for NII, 1994).

Recognising the fact that policy deployment has reinforced the divergence of telecommunications services and thus contributed to its disparities, we turn our focus to establishing how, then, the policy should work. Cowhey identifies the policy dilemma:

> The point is not that users necessarily favour one technology over another. They have such a large stake in the overall telecommunications system that they simply do not want the wrong sort of architectural choice to be made. The special dilemma for public policy is that the right choice from the view point of these large business customers may not be the best choice for the welfare of the country as a whole. Thus, the real moral to the story is that telecommunications carriers and large business users are forcing the series of ever more difficult choices upon public policy. This is reinforced by the growing significance of the drag on the economies of industrialised countries by incomplete universal service (Cowhey, 1994: 548).

This dilemma has been articulated in Mansell' questions on the relationship between network evolution and regulatory innovation (1993b), such as: will access to telematics services approach universality? who should decide whether inclusion or exclusion from the electronic communication environment is important within the framework of public policy? In the transition period in telecommunications from analogue to digital switching and transmission, it is no longer possible or sufficient simply to advocate that traditional public or universal service goals should be met. Questions arise as to what these terms mean, and whether they should be abandoned or redefined. Who creates these new definitions, and with what consequences for competitiveness or consumer lifestyle, also become critical issues (Mansell, 1993b: 6). Mansell suggests that the resources of regulators could be targeted at promoting the development of telematics networks that are designed to optimise access for a majority of users, not a minority (1993b: 19), arguing that public intervention in the name of public service and equity considerations is not only possible but, rather, is essential for a 'universal telematics'.

Standardisation issues are mainly located in the domain of public institutions and in the spaces where negotiations on the adoption of technological developments take place among the players. Mansell argues that an intelligent network could be defined in such a way that it provides the PTOs with a new tool to maintain control over access to the public telecommunication infrastructure, by adopting standards designed to favour a competitive multi-vendor environment (Mansell, 1993a: 28). Standards are also implicated in the industrial policies which governments pursue;

> Standards have been used in a number of ways to infuse public policy goals into the design of technical systems. Government can support certain standards or approaches to standards over others. This can be done through participation in the standards process, and through the provision of funds for selected standards initiatives. In general, however, public sector support for standards is normally channelled through procurement policies and decisions (Hawkins, 1996: 165).

For this reason, standards enter the rationale of strategic business concerns while "standards appear to have less to do with the rational optimisation and exploitation of technology in the public interest, and more to do with co-ordinating technological development with market forces" (Hawkins, 1996: 161).

It has been suggested that the roles of public organisations are: resolving the conflict between economic efficiency and social justice; ensuring effective competition; and playing a positive role in investment and industrial policy deployment. Since regulation is a representation of political consensus between players surrounding telecommunications, the intention of public institutions could be oriented to ensure the direction of telecommunications development towards universal telematics. The space where views and attempts of the relevant players permeate may also be the space where strategic participation of public institutions take place. Further research needs to address the role of regulation and public policy in this respect; but I have chosen not to pursue this theme here any further.

4.5 Conclusions

Telecommunications network evolution includes institutional and technological aspects. The evolution is not simply seen as adding some of technological functions to the existing networks, but the changes are emerging from the very nature of telecommunications. Telecommunications as infrastructure has the characteristics of a public service and a strategic industry. The evolution taking place in the current stage emphasises the strategic industry aspect, which has reinforced the attractiveness of liberalisation.

Telecommunications network evolution is seen as a design process because how the newly available flexibility and capability of network functions are deployed and implemented in the industry is being shaped by social actors surrounding the industry. Service independent network capability could suit the liberalisation of telecommunications, but there should be more concerns on how the infrastructure is built and designed in terms of institutionalisation. Mansell (1993a) highlights the concept of 'network segmentation' as a reflection of the way in which technical innovations in telematics systems are being institutionalised. She suggests that network segmentation is framed within the relative market power of the major network operators and equipment manufacturers.

In the strategic model (see section 1.2.6), the focus can be given to the increasing segmentation in the development of a public network in terms of network access; pricing strategies; and equipment manufacturers that orient open standards. With the concept of TNS (see section 1.2.6), the implications of different infrastructural development arrangements can be observed. We can assume that there can be different settings for network infrastructures which mix public and private networks. This is the space where public institutions should play a role in evaluating the trade-offs between public and private network infrastructural development under different technical scenarios and policy priorities. Social or public service objectives of telecommunications need to be concerned rather than the technical superiority of public infrastructures is simply emphasised.

Chapter 5: Reconsidering Globalisation and Liberalisation

5.1 Introduction

Telecommunications is under reconstruction through globalisation and liberalisation. Because these terms are a cliché of telecommunications restructuring, for our research focus, it is worthwhile to examine them using a more strict terminology rather than just swallowing the cliché as a whole. While network evolution is seen as a design process, these terms lead the new order of telecommunications which is being institutionalised. These issues need to be examined for understanding the changing order of telecommunications; how the growing market power in the industry is being constructed. An examination on these issues also provides a background to understand different implications for NICs.

What those terms mean and how their rhetoric works in shaping the sector will be explored in this chapter by examining global oligopoly (5.2); liberalisation (5.3); the privatisation of PTOs (5.4); and telecommunications restructuring and technology capability in NICs (5.5).

5.2 Global Oligopoly

Pervasive discourses become real, and the reality actually reflects the way in which the discourses are deployed. Unveiling the discourse is an attempt to differentiate the underlying reality from the surface phenomena. We find the reality of globalisation in the phenomenon that several large super carriers in telecommunications expand their business domain with business linkages and physical mergers and acquisitions, looking towards worldwide telecommunications networks. By contrast, the term's use simply implies a ubiquitous diffusion of telecommunications networks from the outset. Our concern is to show how globalisation is being deployed and what is activating it.

The restructuring underway in the telecommunications sector is likely to be intertwined with globalisation in worldwide business. However, if we deal with globalisation in the telecommunications sector simply as an aspect of globalisation in the international economy, it may camouflage the conflicts and contradictions inherent within telecommunications. Globalising telecommunications network evolution is interdependent with globalisation of the international economy rather than possessing a distinct causal nexus.

Globalisation is often referred to in journalism as well as in defined academic discourse. Moreover, international relations between countries have been focused on in terms such as 'imperial expansion' and 'world system' (Wallerstein, 1974), etc. We may wonder what the difference is between globalisation and the 'internationalisation' of the past. Globalisation appears to imply a far more homogeneous world operating beyond national borders, with dynamic production and trade networks working at the level of a global economic system; whereas internationalisation implies an intimate relationship among countries.

In relation to telecommunications, Mansell puts it;

> 'Globalisation' is associated with the structural characteristics of production and markets and the operational characteristics of firms. In all variants of the thesis, the telematics network system is the essential underpinning for the development of new productive 'paradigms'... In essence, an increasing number of globally operating firms depend substantially on electronic modes of communication to centralise or decentralise their R&D, production, marketing and other operations (Mansell, 1993: 6).

How has this new paradigm come to the forefront in the modern society? Technology is certainly behind the phenomenon in terms of facilitating a global and bloc economy. Globalisation has been realised through advanced technological developments in transport and telecommunications systems. In the 1980s, innovations have resulted in a major technical shift in telecommunications from analogue to digital switching and transmission.

The problem here is how the globalising environment is being deployed in the interests of nation states and in the existing international order. A seemingly harmonised world in fact only works to camouflage the conflicts and battles which occur where nation states try to sustain their own interests, often resulting in exacerbating disparities of wealth and development. Globalisation is one form of international order which reflects the changing features of economic performance and of permeation of national interests. In fact, globalisation does not seem to be incompatible with the pursuit of national competitiveness; consequently, it can be considered as an advanced representation of how the existing international division of labour in the global economic system is reinforced.

We can find evidence for this in the phenomenon of regionalism. The world economy exists as blocs. On the one hand, globalisation is invoked with great ideological influence so as to reorganise the global economic order, like the Uruguay Round; on the other, regionalism is also pursued in places in the name of national competitiveness, such as through the EC, NAFTA (North America Free Trade Agreement), and APEC (Asia-Pacific Economic Community) economic initiatives. Regional blocs represent the phenomenon that nation states pursue their interests under a different paradigm.

Globalisation is also interpreted as a new formulation of how global capital transcends nation states (Holloway, 1996). Nation states which apparently compete with each other, actually compete to attract to their territories a share of global surplus value as "the relation of the national state to capital is a relation of a nationally fixed state to a globally mobile capital" (Holloway, 1996: 126). This view is supported by research on the relationship between telematics and economic development conducted by Gillespie (1993). The new telecommunications system is increasingly featured in the "place wars" to attract mobile global investment. In the process of expanding telematics in developmental concerns in geographical terms, the existing order and interests still impinge on the development. It is just under a different form. Despite the common idea that telematics blur geographical identity, Gillespie suggests that;

> the distance-transcending capabilities of telematics do not eradicate the importance of differences between places, but rather allow these differences to find new forms of expression. In this process, places can find new ways of inserting themselves into the networked global economy, to their economic development benefit (Gillespie, 1993: 145).

Pogorel (1994) suggests the current restructuring of telecommunications worldwide is the process of responding to multinational companies' global expansion. "In an endeavour to adapt themselves to the size and structure of the market, operators are involving themselves in a mimetic development: to supply the major world companies, it is necessary to resemble them" (1994: 5). The existence of globalisation requires lower costs, flexibility in the management of information and advanced services for telecommunications network system (Mansell, 1993:7).

Telecommunications is regarded as a means of building competitive advantage for multinational companies (Denmead et al., 1994). In this circumstance, the multinational companies are not passive consumers of services; their requirements and needs become important elements shaping the global network. Telecommunications is now seen by multinational companies as 'a strategic tool' in helping business development. The telecommunications operators and service providers are pursuing business opportunities with these companies, and this impinges on the co-operative relationship between global capital and large global operators. "There has been a shift in the balance of power in the sector, creating the conditions for a dialogue between more equal partners, instead of the TOs and service providers holding the cards" (Denmead et al., 1994: 3).

Mansell (1994) has examined what the MNCs (multi-national companies) actually want from global telecommunications and how they use the PSTN and construct private networks, by investigating three sectors: the automobile sector, the financial services sector and the electronics sector. She contributes to showing the needs and behaviour of MNCs in shaping telecommunications networks. She and Tang also analyse the inter-relationships of the evolution of corporate organisational strategies, the process of globalisation and the development and use of telecommunications (Mansell and Tang, 1993). They emphasise the need to unravel the dichotomy between two prevailing views of the telecommunication development process, i.e. user-driven and supply-led, suggesting that the combined "learning" undertaken within user firms and within supplier firms is blurring the dichotomy, and that "learning" is a determinant of the telecommunication development process (Mansell and Tang, 1993: 9).

Regional differences in orientation towards global activities are examined by Kurisaki (1993), suggesting that new services options, foreign direct investment and outsourcing services are based on globally-operated PTO alliances, which "eventually drive PTOs to form regional cartels, rather than becoming truly global" (1993: 700). Geographical factors are still important in operating networks and in providing services to PTOs, as a "PTO will strive to maintain its competitiveness where it is already competitive in terms of both geographical coverage and services, while at the same time co-operating with other PTOs where its own competitive position is insufficient" (1993: 705).

The globalisation of telecommunications is being constructed broadly along two avenues: first, providing one-stop-shopping services to multinational companies; and second, promoting global expansion by stake-holding and service provision in privatised and liberalised consumer markets. These two strands are being deployed to address the need for geographical coverage, leading to a wide range of global alliances among global carriers (Deanmead et al., 1994). The phenomenon of global alliance is led by several super carriers, leading to, the creation of 'a large world oligopoly structure' (Pogorel, 1994). AT&T, BT, NTT and so on are now eagerly seeking to establish their domains with various types of linkage. Globalisation is seen as 'the battle of the giants' (Yadong, 1992). Since late 1988, a dramatic increase in cross-border acquisition has been observed in the global telecommunications industry.[13] The announcement that BT and MCI will merge under the new name of 'Concert' hit the world telecommunications market in late 1996, as they already covered 6% of the world telecoms market with revenues of £25.6 billion (Guardian, 16 April 1997). Concert is expected to be linked with NTT, targeting the Asian telecommunications markets. The leading players of the industry have already moved to seek alliances. For example, AT&T formed the Unisource Group with PTT Telecom, Telia, Swiss PTT, Telefonica, and World Partners, with KDD (Japan) and Singapore Telecom; Deutch Telecom, France Telecom and US Sprint formed Global One as a separate tie-up (ITU, 1997). This phenomenon reveals a new pattern within the telecommunications industry aimed at an effective distribution of their services through globally tied-up networks. Globalising the telecommunications network certainly signals the intent to create an order in which several dominant players are linked up in an oligopoly.

[13] In 1990, there were 67 cross-border telecommunications acquisitions, worth US $16.5 billion, up from 50 deals worth US $2.7 billion in 1989, and 11 deals worth US $116 million in 1988 (FT, 7 October 1991).

This new order of global oligopoly is possible in the situation where multiple providers in a national territory have emerged. The existing world telecommunications industry which used to be constituted by state monopolies, formulated the international order in the form of International Telecommunications Union (ITU), with which international communications could only be ensured by means of joint agreement. "This co-operation is further facilitated when the number of participants is limited (one for each country), when each is direct control of his environment, when technical change occurs gradually and when there is consensus on the technique and nature of public service" (Pogorel, 1994: 4). In a liberalised environment, where multiple suppliers play in domestic markets and foreign participation is opened up, global alliances between firms have come to replace the existing international order in telecommunications (Mansell, 1996a).

The global oligopoly, however, does not necessarily take place without market expansion, meaning that the global telecommunications market should open its doors to the world's leading players. Liberalisation on the domestic basis in fact encourages the global expansion of TOs. Denmead et al. point out "the threat of increased competition at home - the trend towards globalisation is as much a defensive move as an aggressive move into new markets" (Denmead et al., 1994: 7). They examined the process of transformation of global players, by measuring the level of cross-border mergers, acquisitions and alliances among TOs, and the percentage of TO activities outside of home countries. They found that TOs are still very dependent on their domestic markets. As the competition in domestic markets is becoming rigorous, the super carriers are more eager to seek out new markets. Technologically, this global telecommunications infrastructure implies, "firstly the need for ONP-type systems and secondly, the recognition of the necessity for developing countries to create their own infrastructure" (Pogorel, 1994: 2). Opening the telecommunications market to world players is not only a question of the world trade order, but also, a question of liberalising the telecommunications industry at the national level.

To sum up, globalisation of telecommunications can be considered as a process of supercarriers' formulating a global oligopoly structure, interacting with multinational companies' global expansion. And this requires a liberalised environment which enables them to transcend national borders. This process is supported by world trade order and this is being institutionalised in the form of liberalisation of telecommunications.

5.3 Liberalisation

The telecommunications industry, when regarded as a public sector concern, was kept from competition and, mostly, from private ownership. As telecommunications moves to a profit-making industry from the old regime of public service, we find many explanations.

It is largely accepted that the telecommunications market used to be a supplier-driven market, but that now it is increasingly becoming a demand-driven market.

> Monopoly offered certainty, but it induced an overemphasis on technical matters, because of poor sensitivity to the evolution of the market, the absence of a relationship between costs and tariffs, the formation of cartels with suppliers and weakness at managerial level (Treheux, 1992: 756).

Within this supply-demand perspectives, the argument towards liberalisation of telecommunications is often linked with technology deterministic perspectives, i.e. the argument that the possible technological development simply 'mismatches the existing institutions' (Robinson, 1991).

These perspectives seem to easily assume a linear causal relationship between technologies and institutions, and between supply and demand. That technology is available remains important, but the adoption of technology in the form of institutionalisation implies an interdependency between social choice and technological change. Liberalisation creates challenges for issues examined in earlier chapters: universal service, the changing nature of networks towards service-independence, and telecommunications as infrastructure. These are integrated as a process involving technology and strategic choice rather than relying on a simple demand-supply interaction.

From the technological point of view, and from the historical point of view, the monopolistic provision of telecommunications services has been justified by 'natural monopoly'. We can follow a history of liberalisation in the USA. The liberalisation of telecommunications started in the areas where new entrance is relatively easy to achieve in terms of technology, e.g. data services. With the divestiture of AT&T, services became divided into local and long-distance telephony, and with the second Computer Inquiry, services were divided into basic and enhanced services. This framework formed the basis for regulation and for introducing competition. The framework of liberalisation has occurred in tandem with technological change. In the era of intelligent networks and B-ISDN, supported by ATM technology which is likely to bring service-independent network features, the scheme for liberalisation is now designed to allow full competition in the telecommunications market.

A monopoly has been sustained until recently in the area of access networks, in which a huge amount of basic investment is required. Such monopoly has also been regarded as the basis of universal service provision. In the context of regulatory reforms and emerging services, there has been a suggestion that liberalisation threatens universal service, as discussed earlier (see section 3.2).

Competition in access networks is significant in that it impinges on the basic network structure. In terms of emerging services, existing local exchange companies face the emergence of mobile services thanks to wireless technologies (e.g. cellular or PCN: Personal Communications Network) and high-bandwidth services which are provided by fibre-optic cable; and, the competitors are CATV companies, CAPs (Competitive Access service Providers) or ALTs (Alternative Access Providers). The replacement of copper twisted-pair loops with fibre optic cable by Local Exchange Companies (LECs) has been encouraged, but, CATV companies and CAPs have facilitated the spread of fibre optic cable, which means they can afford to provide telephone services by bypassing the LECs' networks.[14]

A challenge also arises from private networks which are realised in public networks. Gillespie and Robins (1991) show how non-monopolistic environments shape the nature of

[14]CAPs are already practical competitors of LECs and CATV companies had attempted to provide competitive telephone services to the public switched networks through bypass, but they were not allowed to provide telephone services in the US until Telecommunications Act 1996. CATV companies and CAPs are merged in places, which means the boundaries between CATV and telephone services are collapsing in a practical way.

ISDN to give large users the possibility of creating truly private networks through bypassing. They suggest that the proliferation of 'customer specified networks' (e.g. VPN services: virtual private network) provided by RBOCs corresponds to the rapid growth in private networks, and eventually may challenge the universality of service provision.

Is liberalisation of telecommunications inevitable? Noam (1992; 1994) theorises why liberalisation should take place on the basis of network deployment, which he calls 'the tipping of network coalitions'.

> The breakdown of monopoly is *due to the very success of the traditional system* in advancing telephone service and making it universal and essential. As the system expands political group dynamics take place, which lead to redistribution and over expansion. This provides increasing incentives to exit from a sharing coalition, and to an eventual 'tipping' of the network from a stable single coalition to a system of separate sub coalitions (Noam, 1992: 53, emphasis added).

Noam (1994) argues that the emerging system integrators challenge the conventional scenario for the evolution of telecommunications offered by traditional state monopoly carriers around the world. The vision of an 'integrated single superpipe', which merges all communications infrastructure into a single conduit controlled by themselves and interconnected internationally with similarly territorially exclusive superpipes, seems arguably an out-of-date vision on telecommunications (1994: 286). Instead, the new category of 'systems integrators' seeks to provide the end user with access to a variety of services, in a one-stop scheme. These specialised integrators, whose predecessors are known as outsourcers or managed data services providers, typically assemble packages of various types of services and equipment, etc., and customise these packages to the specific requirements of their customers (1994: 287). They relieve customers of the responsibility for integration (which requires expertise), and yet they are not forced to recover major investments as carriers are.

In this process, the telecommunications environment evolves from the 'network of networks' in which carriers interconnect, to a 'system of systems' in which system integrators link up with each other. Noam sees the Internet as an early example of a system integrator (1994: 288). He argues that system integrators, competing with each other for customers, largely resolve traditional problems of price, quality, privacy and market power, by protecting users against carriers' underperformance and power, and getting them the best deal (1994: 289).

Cable and Distler (1995) support this view:

> Networks create economies of scale as the number of users grow, and thus a tendency to monopoly or oligopoly (though networks can co-exist); standards are necessary for networks to work but can entrench monopoly; in a multimedia environment, especially, *systems are important (hardware is no use without software and applications), thereby strengthening monopoly power for owners of system*; size can be used to cross-subsidise services and fight wars through predatory pricing (Cable and Distler, 1995: 3, emphasis added).

The notion of system integrator is supported by technological change in telecommunications networks, which are becoming more service-independent as discussed earlier (see section 4.3). Noam offers an integrated view in explaining liberalisation. Competition in markets with the emerging form of system integrators is suggested as an alternative means to pursue public interests. Thus, whereas Mansell supports the vision of strategically-designed regulatory schemes for protecting public interests in the globalising environment, Noam invokes the market principle. Noam recognises that existing institutions in telecommunications are certainly a barrier in launching the globalising system integrators, indicating that "system integrators cannot truly compete against government or semi-official public telecommunications operators (PTOs) in systems integration, except in market niches" (Noam, 1994: 294).

Noam's theory of the liberalisation of telecommunications provides a convincing perspective on the transition. Above all, his theory is based on the very success of network expansion. The danger we could face in this theory, however, is that we could easily take it as a natural path, one which is inevitable and even desirable. One could overlook the essence of new formations in which the power structures surrounding the transition activate the changes formulating strategic oligopoly. We still need to identify how this activation works in the changing network economy. The institutional process in which the nature of industry moves from a public service to a profit-making industry is not an automatic natural path for institutions. Rather, the change is processed in a specific direction reflecting the power structure surrounding the industry.

To elaborate the issue concerning relationship between liberalisation and monopoly, liberalisation does not necessarily destroy monopoly. The theory of natural monopoly which has sustained publicly-owned monopolies or regulated monopolies has been challenged by technology and success of the networks. In the liberalised market, monopolistic power still survives, and is even flourishing in the competitive market place in general.

Noam and Kramer (1994) admit that the actual demise of monopoly tends to be exaggerated because the notion of an infrastructural monopoly still enjoys political support and the pace of privatisation is slow. In the equipment market, the liberalisation of procurement sources has actually enhanced the power of monopoly PTOs as they are no longer tied to the technology developed by national champion equipment firms. "Corporatisation substituted managerial and financial autonomy for the direct government operational control of PTOs and the political accountability that came with it" (Noam and Kramer, 1994: 284). Privatisation has generally strengthened PTOs with an enhanced role supported by national industrial policies.

However, Noam and Kramer predict this trend will not last long.

> In time, PTO market share will decline as their competitors will grow in size and gain interconnection rights; eventually, unprepared regulators will become more effective; the PTO's national role in industrial development policies will be shared with other forms; and the PTO cartel collaboration will change to more head-to-head competition (1994: 285).

Liberalisation does not necessarily mean the end of monopoly, rather, it creates powerful private monopoly. Their expectation could be convincing in terms of market share but not of monopolistic power.

Whereas liberalisation is proving to be 'suitable' to currently available technology, and to the saturated network for basic telephony, the reinforced status of monopolistic TOs and enhancing competition is certainly encouraged by national industrial policies based on the promoting strategic industry in telecommunications. "There is no doubt that competition will be a powerful incentive for carriers to develop advanced networks to reach markets with high profit potential" (Jones, 1994: 100). This vision is proving to hold water in that competition is being introduced in the area of local competition with the expectation of the construction of fibre optic networks mainly targeting business markets. The US Government took a full step towards liberalisation including access networks and abolishing barriers between local and long-distance calls, CATV, broadcasting, and wireless services in the Telecommunications Act of 1996 (Business Week, 8 April 1996). The fully open competition in telecommunications is inspired by the commitment that the government will encourage industry to invest in the telecommunications infrastructure with the motive of service provision.

The issue of liberalisation is not confined to particular nations. Rather, it follows a global trend in the world trade order. In its international dimension, Robinson (1991) points out that the interpretation of public interests is often used for protective purposes. "The split between those countries in favour of liberalisation of telecommunications and those against focused on the interpretation of the wording 'offered to the public'. This was not just a game of semantics but had major economic undertones" (Robinson, 1991: 99). Robinson, therefore, suggests that a clear distinction will probably be made between the provision of facilities and the provision of services;

> The facilities - the national telecommunications infrastructure - will remain under national control as a strategic necessity for national security. The service will increasingly be offered on a competitive basis through non discriminatory open access to the facilities (Robinson, 1991: 99).

The vision of telecommunications as a strategic industry with public significance is being used, on the one hand, for protection from liberalised markets especially in the opening up the market; on the other hand, it encourages competition in the market for the construction of a national infrastructure. The distinction between service provision and facilities is suggested as a way to compromise in a globally-operated liberalisation process.

Surrounding liberalisation of telecommunications, explanations based on technological changes are dominant. The new technological alternatives which bypass public telecommunications infrastructure seem to have led liberalisation of telecommunications to some extent. The vision of 'system of systems' replacing 'network of networks' actually enforces a liberalisation process in a globally operating telecommunications market.

Problems occur in its international dimension because the technological disparities and the level of infrastructure capacity still differ from one country to another.

5.4 Privatisation of PTOs

The privatisation of PTOs is largely processed alongside liberalisation in telecommunications. Privatisation is discussed as a way to attract private capital into the developing telecommunications infrastructure (Bruce et al., 1994) and as an important part of telecommunications restructuring (Sherer, 1994).

Privatisation, however, reflects the tendency to privatise the public sector in general, and should be understood in terms of broader economic policies which aim to reduce the public sector and replace it with a market-oriented economy. Holloway (1996) interprets the phenomenon of privatisation as capital's inherent movement towards profit;

> Money, in its desperation to find a way of expanding itself, forces open areas previously closed to private capitalist investment: everywhere areas of activity previously controlled by national states are privatised, opened up to the torrent of money in search of a profitable home (1996: 135).

In this circumstance, "telecommunications can be viewed as a sector in which conditions particularly favour a shift from public to private provision. As a rapidly growing, technology-based sector, telecommunications is attractive to both domestic and foreign investors" (Collings, 1994: 568).

Privatisation of the public sector entails a political philosophy: whether it is oriented to support a public system or whether it opts for capital's inherent mobility. In the case of the UK, privatisation reflected the overall political change which produced a flow of laissez-faire policies by the Thatcher government in a post-Fordism environment (Walker and Sharp, 1991). The logic of privatisation often refers to the logic of efficiency. However, the logic of efficiency fluctuates depending on the political philosophy a society adopts. While the notion of efficiency can underpin the logic of privatisation, the logic of public ownership could also employ the notion of efficiency, depending on how policy-makers see the problems. Clark (1990) argues that British Leyland in the 1970s was not unprofitable because it was nationalised, it was nationalised because it was unprofitable (1990: 490). If we look at the origin of the public sector of industry in Britain, it started at the level of local councils which recognised the inadequacies of market provisions since the 1890s. Thereafter, "the post-war expansion of the nationalised industries was pursued by a Labour Government that emphasised the irresponsibility of private capital, the failure of the market system to provide the investment necessary to promote economic development, or to produce even essentials for those who could not afford to pay" (1990: 489) in the process of establishing the welfare state. The notion of efficiency, the very reason for nationalising industries in the post-war period, now becomes the logic of privatisation of the public sector in a different political philosophy.

Some research has identified how political interests are embedded in the restructuring of telecommunications institutions, by pointing to the model of telecommunications regulation and to the ownership system prevailing in a country, and by attempting to understand this model within the context of the political institutions and incentives of that country (Cowhey, 1994). Cowhey divides political systems according to the variables of presidential/ parliamentary, voting and party system, and the degree of federalism, arguing that those variables strongly influence the choice of telecommunications policies. After all, privatisation is a financial bonanza for political supporters as it provides the government with funds for specific public works projects, and it gives the middle class big financial benefits through stockholdings. In the case of Mexico, Salinas was able to reap a special benefit from his telecommunications policy because he could take his time in introducing change and make it part of a broader set of policies to revitalise Mexican financial markets, already one of the best developed in Latin America.

> Forty percent of TELMEX stock is reserved for Mexican nationals; the value of the stock has appreciated considerably since privatisation. A stock certificate in every household is almost as good as a chicken in every pot when the company is a well-financed monopoly whose new ownership structure assures that its incentives are largely business expansion, not distributive politics (Cowhey, 1994: 558).

The restructuring of telecommunications embodies the existing economic and social structure of a country at the point when privatisation and competition are processed. Constantelou (1993) examines the privatisation process in Greece, suggesting that privatisation does not necessarily bring effective competition in specific political circumstances.

> The political infrastructure of the country, the high level of bureaucracy and inconsistent government policies for the sector do not guarantee a painless passage from monopoly to competition ... It is doubtful whether the new regulatory body will be free from political intervention since it will be vulnerable to external and internal pressures from potential suppliers who will wish to 'cream-skim' the most promising parts of the market (Constantelou, 1993: 444).

Privatisation is pursued to respond to capital's global expansion in accordance with liberalisation supported by specific political philosophies. In the context of telecommunications, a holistic picture has been offered so far. How telecommunications restructuring reflects the existing economic and political order still needs to be examined in a specific social context. The next section examines issues concerning telecommunications restructuring generally raised in the context of NICs.

5.5 Telecommunications Restructuring and Technology Capability in NICs

> Capabilities, in the sense of the power to act, can be expressed as a result of action embedded in institutions (as organisations) as well as by the actions of individual agents. Power can then be conceived as a capability that varies as a result of the accumulation of knowledge as well as the constraints and opportunities in an actor's environment (Mansell, 1996: 28).

We have seen how global telecommunications is being shaped. There is, however, a clear distinction we must make concerning the interests and circumstances different countries face in terms of the international division of labour. This section looks more specifically at the context of the Newly Industrialising Countries (NICs), to prepare us for the case study of Korea. In most developing countries, issues such as underdeveloped telecommunications infrastructures and largely inequitable access to telephony are discussed. However, in Korea, these issues do not seem to be quite as relevant any longer. The 30% penetration rate is not sufficient of course, but obviously the issue of Korean telecommunications does not lie in the 'Missing Link',[15] but in improving network capacity towards broad-band ISDN and in analysing the effect of changing regulatory schemes in the global regime.

---

[15]*The Missing Link* is the report of the Independent Commission of the International Telecommunication Union (ITU). This report pointed out the plight of developing countries which do not have even an elementary telephone service in many regions and, in the cities, labour under inadequate, inefficient and old-fashioned services, and stressed how this would seriously affect their economic development. The *Missing Link* is now

Sectoral development responds to developmental concerns which the developmental state promotes in its relationship with society (see section 1.2.4). Restructuring in telecommunications, however, still has a close relationship with the level of technological capability; with which telecommunications network is deployed; with the level of investment; and with industrial aspect of telecommunications specified in the NICs. Undoubtedly, the relationship between investment and the level of development is found in the notion that the level of wealth may be the key determinant of IT investment (Kraemer, 1993). Developmental concerns, here, cover the issues of whether the restructuring of telecommunications contributes to economic development - in other words, whether it improves the country's status in the hierarchy of the international division of labour.

The NICs, in general, are faced with the dilemma that, on the one hand, they need to improve their network functions to keep up with international levels; and, on the other, they need to develop their manufacturing industry from which the telecommunications services sector purchases the equipment. In situations where the PTOs and domestic manufacturers enjoy close relationships, the service sector tends to purchase its equipment from domestic manufacturers. This close relationship is collapsing in developed countries, and the new world trade order does not allow the NICs to sustain procurement linkages which support domestic manufacturers. Most NICs rely heavily on imports for their equipment and their network facilities. Freeman and Hagedoorn (1992) point out that internal R&D in developing countries is still essential on a national basis, given the international nature of science and technology and the globalisation of technology;

> Otherwise the imported technologies can neither be understood, nor adapted to local conditions and resources, nor modified to meet local objectives, nor improved to keep pace with world competition, nor changed to cope with local environment conditions, regulators and hazards (Freeman and Hagedoorn, 1992: 17).

Standardisation issues are raised in the context of importing equipment, which facilitates the national network. Mansell and Hawkins point out that "long-standing patterns of technical dependency between 'developed' and 'developing' countries are often reinforced by standards, which typically, only developed countries have the resources to define"

---

often cited in telecommunication issues in developing countries, or invoked as a metaphor for a poorly developed infrastructure of telecommunications in developing countries.

(1994: 17). Standards reflect the protection of intellectual property rights in the context of international trade.

Hoffman and Hobday (1990) look at the telecommunications industry in NICs, focusing on equipment supply sector. They emphasise digital semiconductor technology as a key element in the telecommunications supply sector. According to them, the traditional suppliers must now compete with new entrants such as Japan, South Korea and Taiwan through technological convergence; in particular, "vertically integrated, large conglomerate information technology corporations from Korea and Japan have invested substantial long-term financial resources in telecoms in their efforts to challenge the traditional 'electromechanical oligopoly' of western equipment supply firms" (Hoffman and Hobday, 1990: 330). These firms have targeted Third World markets aiming at deep penetration, and giving R&D commitments, particularly in digital exchanges, hoping to capture a large share of the relatively open markets of the developing countries (Hoffman and Hobday, 1990: 331). Hoffman and Hobday look at the possibilities opened up by the modularity of the software and the divisibility of network equipment for capacity accumulation and collaboration between developed countries and NICs. They suggest that NICs can develop and manufacture selective elements of less complex equipment, and so gradually 'learn' their way up the chain of technological complexity (Hoffman and Hobday, 1990: 336). They further suggest that the areas of equipment supply and technological development be dealt with separately from regulatory issues, arguing that in areas such as purchasing power, standard setting, etc., the governments of NICs will not cede control to the private sector or outside agencies, or diminish their influence over developmental concerns (Hoffman and Hobday, 1990: 339). They point out that the effect of liberalisation and privatisation in developing countries could result in a much worse situation, because of inexperience and technological and managerial incompetence in the private sector, inequitable income distribution, corruption, a barely functioning market and the inefficient manner which PTTs must cope with (Hoffman and Hobday, 1990: 344). In consequence, they warn of negative effects of liberalisation[16] due to inherent inequalities and poorly planned regulatory reforms in NICs (Hoffman and Hobday, 1990: 346).

I find to some extent convincing the argument that the key issues for the NICs are more associated with capability problems since network evolution partly depends on the availability of technology. However, the institutional issues in NICs are rather complicated because of that, in terms of their explicit developmental concerns. On the one hand, NICs should seek to establish reasonably well-defined institutions in terms of meeting public interests; and, on the other, NICs need to consider their own manufacturing industry rather than simply purchasing equipment from foreign markets. In other words, they need to improve their status in the hierarchy of the international division of labour. It would be misjudged if telecommunications issues in NICs were addressed only in terms of capability issues. This could imply the issue should be how to learn from the developed countries rather than how the NICs build up their capability coupled with how they should respond to the global requirements of the industry. The issue of capability is also concerned with how a society is involved in the process of developing the sector.

Some research has explored the relationship between telecommunications restructuring and the economic significance of the sector in developing countries. Hanna (1991) examined how significantly information technology contributes to economic and social development in the developing countries by looking at how informatics is applied to priority sectors. Scherer (1994) discusses how telecommunications reform correlates to general economic reforms. He suggests that telecommunications reform in developing countries should be carried out in accordance with strategic economic development rather than myopic fiscal and debt management concerns, recognising that information technology is not merely an element supporting the infrastructure but a driving force of economic growth. He even suggests that reforming the telecommunications sector may act as a catalyst for broader economic reform (Scherer, 1994: 77).

---

[16]The US fully intends to directly influence institutional reform in these areas at the multilateral and international level as well through representation and proposals being made to GATT, WIPO and the ITU on the treatment of intellectual property and international trade in services (Hoffman and Hobday, 1990: 348).

For this reason, developing countries need to act more positively in restructuring efforts rather than simply deploying protectionist policies.

> Subsidising domestic telecommunications manufacturing capability by setting restrictive standards, imposing reserve procurement, or providing tariff protection has shown limited benefits at best ... Examples in Eastern Europe, Brazil, and even Korea indicate that the development of switches, just to pick an item with some national appeal, has had either negative rates of return or rates below the opportunity cost of capital, if strict economic calculations are applied (Sherer, 1994: 81).

It seems that Sherer encourages positive restructuring in NICs, including breaking the traditional tie between carriers and manufacturers, used for technology capability building in developing countries. The notion of positive restructuring is problematic if this contradicts capability building. The capability building process encompassing technology and network evolution in NICs takes place in a complex context. The main problem is that it is still not clear which methods of telecommunications restructuring might suit the needs of any one country's society and economy. The capability building process also includes how ubiquitous network functions are deployed over the country in terms of equity concerns.

Mansell (1988) explores how the OECD countries aim to provide universal service in the context of regional developments by focusing on the discrepancy between the demand for sophisticated services and the on-going need to provide universal service. Although conducted in the context of the OECD countries, the research's implications about the relationship between regional development and telecommunications are relevant to the dilemma NICs have in restructuring their telecommunications. Newly emerging technologies and services,[17] by themselves, cannot transform regional economies directly; rather, transformation depends on "the design of new technological systems, their performance characteristics, cost factors, pricing strategies, regulatory policies, and of course, the absorptive capacity of the region"(Mansell, 1988: 140). Mansell suggests that planning for the introduction of new information and telecommunications technologies must take into account the wider economic, political and social framework if opportunities for regional development are to materialise (1988: 144).

---

[17]They are realised in telecommunications services and various organisational applications, such as computer integrated manufacturing, LAN (local area networks), ISDN, and satellite communications.

The NICs seek to establish telecommunications reform which corresponds to the requirements imposed by the world trading order and to the internal need to develop a telecommunications industry with respect to both manufacturing and services. In establishing a development strategy for telecommunications, two paths can be identified: the French and the USA.

> In France, the strategic objective has centred on providing an integrated network through a government monopoly that features one of the world's highest rates of network digitisation, the largest packet-switching network, and the national availability of ISDN service ... In contrast, the overarching goal in the United States has been the competitive provision of a wide choice of networks and network services by the private sector. Competition is being relied upon as the driving force to bring down costs and to foster dynamic innovation in telecommunications equipment and services. As a result, large telecommunications users have unmatched access to a wide array of telecommunications resources and substantial freedom to control their deployment and use. The different approaches followed in the United States and France have resulted in significantly different telecommunications infrastructures and regulations in the two countries (Sherer, 1994: 73).

India has adopted a policy not of privatising the existing public sector but of allowing private enterprises to come into being so as to generate facilities and services. Chowdary (1992) argues that in the context of India's liberalising and outward-looking economic and industrial policies, the route of not privatising existing government or public sector telecommunications services but of allowing new producers to contend with one another, is the best policy (1992: 602).

Mansell and Jenkins (1992) examine the restructuring process of telecommunications networks and policies in Singapore by looking at the role and implications of the EDI system in relation to Singapore's economic structure. They conclude that when the network is constructed in a direction that responds to the economic and social needs of the country, universal access as well as economic efficiency can be pursued simultaneously. Singaporean telecommunications development exemplifies a strategic economic policy in developing that country (Sherer, 1994) as a centre for international commerce, financial and banking services, transportation, and electronic publishing using reliable, efficient and sophisticated telecommunications facilities.

The issues surrounding the development of telecommunications in NICs reflect a complex reality. Developmental concerns encompass technological capability building and seek a useful way to restructure. This should correctly address the social and economic needs of society; equity concerns, represented in the form of universal service debates, should not lag behind the design of network infrastructures. How developmental concerns can be pursued in tandem with universal access rather than solely within the context of a narrowly defined issue of 'national competitiveness' needs to be addressed.

5.6 Conclusions

Understanding the transition of telecommunications includes technological and institutional changes. This chapter provides a deep consideration of globalisation, liberalisation, privatisation and implications of these issues in the NICs. Globalisation of telecommunications is being constructed to provide services to globally operating multinational companies, and the telecommunications industry per se is formulating a global oligopoly structure by stake-holding and service provision in privatised and liberalised consumer markets. This new order of global oligopoly is possible in a liberalised market place where multiple providers in a national territory have emerged and where the new form of telecommunications trade as commercial service have emerged.

Liberalisation has been pursued from the territories where supercarriers provided services in a domestic basis in the first place, and this is now a pervasive institutional form of change in a worldwide basis. Telecommunications, as a potential profit-making area has become a target for capital's global business expansion, and privatisation of PTOs is processed to respond to capital's interests. Privatisation of PTOs need to be examined reflecting national context in terms of political system and social relations since the issue is more associated with internal dynamics of capital accumulation and political circumstances.

In the strategic model, the dynamics of structuring global oligopoly, and their expression through the technical and institutional design of the telematics network system, provide a more realistic explanation for the 'globalisation' process at the macro-institutional level, whereas the 'idealist vision' of globalisation still ignores the disparities of diffusion and biases which social agencies create in the process of production. Global oligopolies, which responds to the global expansion of capital, together shape the global telecommunications network with the growing significance of service independent network architecture.

Capital's global expansion and the response of the telecommunications industry impose a far more complicated situation in the NICs. Developmental concerns are not simply associated with a domestic matter, but with a concern of the national status in the hierarchy of the international division of labour. How the changing order of telecommunications shape the telecommunications industry in the NICs and how the internal social relations and developmental concerns in the NICs respond to the changes can be examined in the strategic model.

Chapter 6: Conclusions of Part Two

The changing nature of telecommunications networks is one of change into software-intensive networks which are indebted to the digitalisation of these networks, and which bring polarised power relations into the industry; economic incentives permeate developing networks in the form of industrial policies and national initiatives in developing the telecommunications infrastructure. The role of public organisations in this environment is becoming more complicated because of the need to ensure competition and to resolve conflict between developmental and social equity concerns. The review of the universal service debate in chapter 3 indicates my hope to establish a way to realise public interests by reflecting on the broad political nature of universal service. Nevertheless, I decided not to restrict my research issues of how universal service is defined, or of how cross-subsidy and geographical availability are concerned. Rather, I attempt to bridge the gap between technological development and universal service, by combining the public interest issues with a focused analysis of the sociotechnical construction behind telecommunications evolution in Korea.

Understanding the changes in telecommunications within the strategic model requires us to identify the power structure which controls the new order. Technology, demand-supply and network tipping could explain the phenomenon, but we still face the question of where this change leads us. The breaking down of the existing order is not certainly as easy as supporting that order; and there are actors, rules and philosophies to sustain or change it. The state, supercarriers and capital in a global dimension, national carriers, and the general public can be identified as actors.

Telecommunications have generally required public intervention because of their economic significance and their status as a tool for realising social integration. However, the specific manner of public intervention differs, reflecting the economic and political system of a society. The social and economic interests of NICs are different from those operating at the world telecommunications level. For example, in NICs, strong government intervention is found in many aspects of economic performance; and where the political circumstances are authoritarian, intervention also reflects the dynamics of power relations in that society.

In the context of telecommunications in NICs, technological capability can be a substantial issue, in addition to the general issues such as universal access, regulation, pricing, network design, etc. Successful technological development coupled with the economic developmental process in the NICs is obviously a substantial concern. However, the success story is often highlighted in terms of numerical outcomes and of the elements which seem to prove the 'success'. Putting aside the extent of any claimed 'success', it is not always fair to look only at the value of development in visible outcome in the NICs. An alternative is to look at the way in which developmental concerns are being pursued so as to reflect the goals of civil society.

My research is an attempt to enlarge our understanding of how the political and economic spheres interact with network evolution drawing on empirical evidence. In particular, an investigation of network evolution with respect to innovation and the design process is placed in the context of NICs which are under pressure from liberalised markets on a global scale. By doing so, I am hoping that the space where telecommunications embodies public interests and the ways to realise it, can be revealed.

PART III

THE EMPIRICAL CASE STUDY OF KOREAN TELECOMMUNICATIONS

Chapter 7: Social Relations and Economic Development in Korea

7.1 Introduction

The transition of telecommunications, including the privatisation of PTO, can be understood in the context of Korean liberalisation policies as well as in the sectoral characteristics of world transition. The open market policy cannot stand alone without taking into account the context of the changing economic structure of Korea in terms of the interests of capital and the logic of the capital accumulation process. The notion of globalisation cannot be understood only by simply considering it as an external economic policy; rather, it is essential to locate the notion in the context of the economic characteristics and class relations present in Korean society. The questions are what peculiarities can be found and what particular needs of state and capital can be identified in the transition of telecommunications in Korea.

This chapter takes the first step into case studies by exploring Korean society. A series of economic and political policies, such as deregulation and privatisation, are being deployed in the prevailing discourses of 'national competitiveness' and 'globalisation' in present-day Korean society. This chapter deals with understanding this phenomenon, presenting a brief picture of Korean society with respect to social relations and the process of economic development, in order to provide the background to the case studies. Section 7.2 examines social relations, and in particular state-society relations as a basis of social conditions. Section 7.3 looks at the process of economic development intertwined with changes in political circumstances in order to locate current policies within the internal societal dynamics.

7.2 Authoritarian Developmental State and the Social Conditions

If we look at Korean society, a unique picture is captured in the centralised authoritarian political system. Unlike many other European societies that experienced a decentralised feudal system in the Middle Ages, the feudal system in Korean history is characterised as a centralised feudal system; the centralised power of the King governed the nation on the basis of a tax system. This tax system was made up of farmers who were more likely to be common people rather than a group of peasants ruled by landlords (both economically and politically), as was the case in the European and Japanese feudal system.

The centralised system is recognised as one of the factors enforcing state power in the context of the Confucian tradition. In particular, the long tradition of bureaucracy whose administrators have a broader responsibility, authority and respect than in the West, is recognised as contributing greatly to the state interventionist transformation (Hassink, 1994: 10).

The centralised feudal Kingdom, *Chosun*, was destroyed by the Japanese invasion [1910-1945], which bridged modern society in Korea in a way which distorted the internally developed economic and political basis. The newly established government [1948] in the south, formed after the Japanese withdrawal in the second World War [1945], adapted the American presidential system, which was fundamentally supported by the US foreign affairs policy in the beginning of the Cold War era.

Korea is a divided nation with a ruling system in the south which has had a strong anti-communist ideology since the Korean War [1950-1953]. "The Korean War transformed the South Korean state from an extremely unstable and fragile anti-communist state into a powerful bureaucratic one ruled by an authoritarian regime" (Choi, 1993: 22). Cho (1995) conceptualises the Korean society as an 'anti-communist right-wing society' with respect to specific social and class relations. This peculiarity of society was formed through an interaction between the Cold War on a global level and the civil war (the Korean War) on a national level. "Anti- communist right-wing society in post-war South Korea can be defined as one in which the Cold War logic was, through the historical experience of the civil war, transformed into an internally consensual one and it regulated social relations and behaviours of the populace, resulting in labour discipline and popular acquiescence" (Cho, 1996: 17).

The civil dictatorship established soon after the civil war, continued to rule the nation until the new democratic parliamentary system came into being, brought about by the '4.19 civil revolution'[18] in 1960. This period of democracy was short-lived owing to a military coup d'état. The military became a powerful single-minded carrier of the growth strategy dominating Korean modern history, both socio-economically and politically. The military dictatorship governed the nation for over thirty years (1961-1992), and this required strong centralised political power without introducing local government at the district level.[19] Because of the long history of authoritarian political power, the mechanism which governs society is still authoritarian.

The rapid economic development experienced by Korea has been carried out under the hegemony of the Government since the 1960s. The export-oriented economic development was chosen because the Korean economy fully relied upon foreign debt as an initial investment source and domestic demand were limited. As a result, the Korean economic structure is intimately involved in the vertical hierarchy of the international division of labour.

The government economic development initiative in Korea created a peculiar feature of economic structure whereby several large conglomerates (*chaebol*) dominate most of the industry. Instead of operating a market mechanism, the government initiative intervened with investment by allocating resources and funding private enterpreneurship to selective companies (Amsden, 1989). Small and medium sized firms lie within the vertical supply chain with the large conglomerates, in the sense that they supply their products according to the demand of large conglomerates. The process of rapid industrialisation has deepened the discrepancy between urban and rural areas and among social classes. This is the basis for the authoritarian developmental state based in relation to the concept of 'developmental state' defined in section 1.2.4.

[18]'4.19 civil revolution' is a historic civil movement in Korean modern history. It was against the civil dictatorship and it was also a result of economic crisis caused by the transition from the economic system relying on the US aids to the system relying on foreign debt mainly from the USA.
[19]In 1992, local parliaments and governments were newly constituted, following the limited existence of local sovereignty in the 1950s.

State intervention is biased in the context of social relations, in particular, in the process of allocating resources. Cho puts it,

> State's autonomous interventionist role means mainly state's acts and policies for arranging scarce social-economic resources unequally in favour of bourgeoisie for their successful capital accumulation under the bad accumulation environment. This socially biased accumulation policies inevitably bring with it more acute conflicts among related groups and classes (1996: 13).

The emphasis on social and class conditions in understanding state's autonomy provides the perspectives of 'relations' with which state's autonomy and the social relations are in state of flux. In other words, the very success of state's intervention in economic development brings changes of social or class conditions: *chaebol*, not strong and stable enough to have stood on its own feet, has found a stable basis for capital accumulation; working class have become mobilised to change their status as they are against the authoritarian regime; and again, these changes bring challenges to the existing state-class relations. In turn, the state transforms its means of intervention into a more coercive form. The changes of social relations with respect to the social class conditions and state-class relations are the basis for understanding the current changes in Korean society. This reflects the way the state resolves its economic and political crises since the 1980s.

The next section looks closely at these changes in the process of economic development in Korea.

7.3 The Process of Economic Development

The economic performance of Korea is widely acknowledged as one of the successful cases in the context of NICs. Between 1970 and 1991, the annual GDP growth averaged 9.6%, which is three times more than the average rate of the world economic growth. The GDP grew from $ 8.9 billion in 1970 to $283 billion in 1991 (Office of Statistics, 1993). GNP per capita has become close to $10,000 since 1995. In the process of industrialisation [1961-1990], there was a drastic change in industrial structure, the transformation from a typical agrarian society into an industrial society. In 1960, the turnover of agriculture, manufacturing and service sectors was 39.9%, 18.6%, and 41.5% respectively. In 1992, corresponding figures were 7.6%, 45.0% and 47.4% (The Bank of Korea, 1993).[20]

In this section, I examine the process of economic development in Korea, which has been interwoven with political circumstances in establishing strong government initiative in the economic sectors. It is beyond the scope of this study to look at the whole process of economic development in Korea. The description here, focuses on the events leading up to the open market policy in the 1990s, which reflects the internally developed crisis of the Korean economy. I will examine first the initial process of economic development in section 7.3.1; second, the economic policy transition in section 7.3.2; third, the discourse of 'national competitiveness' in the 1990s in section 7.3.3; and finally, privatisation in section 7.3.4.

The crisis faced by the Korean economy initially occurred in 1979 -1980. This crisis of capital accumulation coincided with the end of Park's eighteen year military regime which was succeeded by Chon's. The crisis, however, resulted from the limitation of the capital accumulation process which had been undertaken since the economic development initiated in the early 1960s.

7.3.1 Initial Stage of Economic Development

The state's economic development initiative in the 1960s and 1970s was established with the ideology of social integration combined with the slogan of 'Modernisation and Economic Development in the Nation' and anti-communist ideology.

---

[20] It is worthwhile to look briefly at some of the Korean standards of living statistics as follows. GNP per capita: $ 10,000, 29th in the world; Population: 45 million, 25th in the world; Population Density: 443, 3rd; GNP: $ 378 billion, 11th; Trade: $ 198.4 billion, 12th; Ship Production: 2nd; Car Production: 6th; Electricity Production: 3rd; Population of Higher education (over polytechnic): 4,766/100,000 population, 3rd; Rate of attendance at High School (primary: 6 years from the age of 7, middle school: 3 years since the age of 13, high school: 3 years since the age of 16, university: 4 years from the age of 19): 50.8%, 5th; Newspaper publications: 412 out of 1,000 population, 7th; Book publications: 9th; Car ownership: 166.6 out of 1,000 population, 33rd; Rate of Car accidents: 598.6 out of 100,000 population, 3rd; Rate of death by car accident: 22.7 out of 100,000, 6th; Expenditure of social welfare system: 1/3 of advanced countries; Rate of Divorce: 1.5 out of 1,000; Working time per week (in manufacturing): 48.7 (53.8 in 1985); Telephone subscription in 1993: 378 out of 1000 population, 34th; Mobile Telephone Subscription in 1993: 107 out of 1000 population, 33rd (Office of Statistics, June 1996).

The initial economic development was crystallised in the strategy of export-oriented industrialisation, reflecting the demand of the world capital system. The industrial focus of the developed country was moving towards high technology industry. The international division of labour this produced provided an opportunity for Korea in capturing the low-skilled and low-waged sector, the so-called 'light industry'. On the one hand, the state protected domestic capital from foreign capital and fostered several selective domestic companies. The state controlled distribution of foreign debt[21] as well as establishing an institutional mechanism for raising and distributing domestic resources.[22] On the other, it ignored the demands of the labour class which also became more established during the process of industrialisation.[23]

The industrialisation, mainly focusing on the light industry, was successfully carried out in the 1960s. Economic development, however, was faced with a changing environment. The regulation and protection against importing light industrial products in the developed countries began in the early 1970s, and as a result, the competition with other late developing countries became fierce. In addition, the increase in the level of light industrial product exports led to a greater need for importing machinery (heavy industrial products). In 1973, a new direction of economic policy was undertaken which focused on heavy industry. At the same time, the state established stronger initiatives in the capital accumulation system by distributing resources.

---

[21] The state initiative of controlling foreign debt was a significant way to intervene in the process of capital accumulation in the initial stage of economic development in Korea (where the domestic capital has not been accumulated enough to perform industrialisation). The state could select companies, certain industrial areas and certain districts according to its 5 year consecutive economic development plan, which began in 1962. The state chose to foster a certain group of companies based on assessing privileged status rather than a large number of companies based on competition. That is the root of '*chaebol*', the famous peculiar presence of Korean large conglomerates. The legal and institutional system for the introduction of foreign debt was initialised in early 1960, by establishing 'The law for promotion of introducing foreign debt', and, 'The law for introduction of foreign debt' in 1966.

[22] For instance, the state manipulated the capital-raising mechanism in order to promote integration of social resources into the bank system, which can be used by certain limited companies as well. 'The rationalisation of interest rate' in 1965 is largely recognised as the representation of this mechanism.

[23]The state controlled and repressed labour class by the extreme restriction of the establishment of trade unions and collective activities. The control has been undertaken through official violence mainly, but, on the other hand, ideologically, the state used the 'red complex' in South Korea. The trade union movement is often accused as propaganda of communism. The flag of 'economic development' is also used in a way which justifies the low-wage and lack of a social welfare system. This ideological control has actually worked in integrating social consensus.

This state initiative over the system of capital accumulation created the following fundamental conditions in Korean economy and society. First, the repressive labour class structure was created in the process of the rapid export-oriented economic development which required intensive forms of labour process. The export-oriented economic structure relied on demand from foreign countries rather than on domestic market demand. The low-wage and long-working hour policies were pursued to sustain price competitiveness in the foreign market, reinforced by the strong authoritarian state power. Second, whereas the selective capital fostering policy has created a few large conglomerates, called '*chaebol*'[24], which have an overwhelming power of over 70% of production in the whole economy, it also largely created the *chaebol*- dependent small-medium sized companies in the production and distribution chain.

7.3.2 Economic Policy Transition and Open Market Policy

If one can call the 1960s and 1970s in Korea 'a period of economy', one can possibly refer to the 1980s as 'a period of politics'. In the 1980s, drastic changes in terms of political upheaval occurred. This period brought about disintegration and reorganisation of the 'anti communist right -wing society' (Cho, 1996). "Confronted with active political upheavals, the developmental authoritarian regime was forced to change its developmental strategy that was organised only on supporting the growth of the bourgeoisie and sacrificing all other popular sectors" (Cho, 1996: 27). Transforming the developmental strategy occurred through the economic and political liberalisation policies. The reason for transforming strategy was an attempt to resolve the economic and political crisis of the developmental authoritarian regime.

The crisis in 1979-1980 has quite a high profile, both economically and politically, in Korean modern history. Apparently the economic crisis initially stemmed from a political

[24] The term '*chaebol*' in the Korean sense implies 'financial clan' or plutocracy. The first peculiarity of '*chaebol*' is that it is involved in many areas of business, for example, *Samsung* is involved in semi-conductor, domestic electronics (which is well known), heavy industry in manufacturing military weapon and air craft, food making industry (the origins of *Samsung*), department stores and the car industry (for which it was recently granted a licence). Second, the ownership is dynastic. On the one hand, the privilege of *chaebol* in terms of investment and resources provided by government, worked in terms of the efficiency and integration of investment in the economic development process. On the other hand, it has coexisted with corrupt political systems which established an organised way to sustain its regime through financial support from '*chaebol*', which takes the institutionalised privilege from the political power in getting credits and licences.

vacuum, caused by a consecutive series of political challenges by the civil movements (represented by the 'Pusan-Masan Civilian Struggle' in 1979 and the 'Kwangju Civilian Struggle'[25] in 1980) and counter coup d'état by the military group in 1980. However, it is largely recognised that the Korean economy already faced the limitation of the state initiative for controlling capital accumulation. This was because the focus on heavy industry exports was not successful as the long-term depression of the economy in the developed countries had been further deepened following the second oil shock in 1978.

The state encouraged investment by domestic large conglomerates through the construction of large-scale factories for heavy industry. It did this without considering the scale of the domestic market as the heavy industry was fostered in order to nurture exports in the 1970s. The large conglomerates, which believed that the state would underwrite their investment risks, invested in the industry competitively and redundantly. As a result, investment in light industry which had the international competitiveness, was neglected. This led to a high rate of inflation, along with a rapid increase in the cost of skilled labour in heavy industry. The state tried to convince the large conglomerates to reduce the investment in heavy industry in the face of this economic crisis, but the large conglomerates were strongly against this reversal of policy as they had already embarked upon their investments. In consequence, the cost of the economic crisis was passed on to groups who did not possess economic and political power, especially to the light industry labourers, who were alienated in the process of fostering heavy industry. In 1979, a historic civil movement against the military dictatorship emerged in Pusan and Masan, the main bases of light industry. This was caused by frustration from the economic suffering. The Government repressed the

[25] 'Kwangju' is a city where 2,000 civilians died at the hands of the military forces in 1980. 'Kwangju' is a symbol of the democratic movement in Korean modern history, and 'Kwangju' has been an original sin for the political power which has governed the nation since the massacre. Chon had been president for seven years (1980-1987), and Roh, who is second head of the coup d'état, became president through election. This election resulted from the civil movement in 1987, but it did not bring a civilian president because of the split of leadership in the democratic movement group. Chon and Roh were enjoying their power until they were accused of being responsible for military coup d'état, the massacre in Kwangju and bribes they took during their respective periods in power. Chon was given the death sentence and Roh was convicted to life imprisonment in September 1996, by the present government. The present government is led by one of the politicians involved in the split leadership in the democratic group in 1987, Kim, Young-Sam. Kim joined the party which the military group, Chon and Roh, had established, and he became president in 1992 by election. Because he also joined the party which bears the 'Kwangju' original sin, he faced the dilemma of responding to the demand from the civil movement to accuse Chon and Roh, and the internal power relations in the party. Sixteen years have passed, but although the leaders were convicted, the spirit of 'Kwangju' lives on and will last until democracy is established in Korea as it did in the 1987 civil movement in Seoul and Kwangju.

movement, but the military regime was soon ended by the assassination of the president, Park.

The political vacuum was filled by a counter military coup d'état led by Chon. Chon's regime employed 'Economy Stabilisation Policy', which was aimed at rearranging the large conglomerates in a selective way, such as the rearrangement of heavy industry investment and insolvent firms, and so on. The policy has been gradually undertaken in the transition from state initiatives to private sector initiatives and the open market system. The open market system includes privatisation of banks, privatisation of public companies and activating the capital market.

In the 1980s, the Government started to deploy a series of policies for opening markets, liberalising imports and liberalising capital markets, partly because of the demand from *chaebol*, and partly because of the demand from the world market. Since the early 1980s, *chaebol* has urged that government intervention should be reduced, and that open market policy should be delayed until *chaebol* becomes competitive enough. The control and intervention of the state began to be seen as fetters for *chaebol.*

This argument about 'transition towards the private sector initiatives' shows the changing position of *chaebol. Chaebol* has expanded through the privilege given by the authoritarian state power, and they are now requesting the change of state's role. In the process of economic development based on state initiative, the state restricted and controlled the competition between capital by integrating limited resources into selected firms. In the past, this suited the needs of *chaebol.* In other words, the state intervened in the free accumulation activities of *chaebol* by institutional tools of licensing, to prevent over-competition and to provide a stable environment for the selective *chaebol.* The intervention, however, now became a barrier for the matured *chaebol.*

7.3.3 The Discourse Of 'National Competitiveness' in the 1990s

It is in the 1990s when the requests on 'private sector initiatives' from *chaebol* and the pressure from the changing environment of the world market are becoming integrated into the discourse of reinforcing 'national competitiveness'.

The new government, launched in 1992 with the declaration of the end of military dictatorship, has been spreading the discourse of 'national competitiveness', coinciding with the one of 'globalisation'. The discourse of national competitiveness is the logic of capital, which replaces national competition for the rigid competition among world capital. This discourse is linked to social integration and appeals to nationalist sympathy to conceal class relations and resolve class conflicts.

The national interest and the developmental projects could represent the class interests of the bourgeoisie, "which are based on state's 'super mercantilist' support of them and 'super exclusion' of working class and popular sector, and they could be extended to be hegemonic projects" (Cho, 1996: 15). The discourse of national competitiveness has been introduced to camouflage the support for capital whereas it is a way to persuade people to logically justify the repression over labour class. "'National Competitiveness' is the ideology of Kim's regime to support the large conglomerates in the 1990s in the same way as the ideology of 'Modernisation and Economic Development of the Nation' was used in Park's regime to justify the initial capital accumulation in 1960s" (Saw and Lim, 1994: 235).

'The 5 year plan for the new economy' presented by Kim's Government focused on reinforcing national competitiveness, including 'rearrangement of industrial structure', 'deregulation to protect manufacturing system', and 'social stability for reinforcing competitiveness', etc. Although the economic development in Korea has proceeded in a way which has created the large conglomerates and expanded their realms, there have also been regulations to restrict their activities. For instance, the Government restricted the large conglomerates' investment in some areas with such institutional tools as 'exclusive areas for small and medium sized firms', providing the small and medium sized firms with a relatively safe environment, 'restriction for debts to bank for 30 large conglomerates', and 'designation of investment in the specified areas' which restricted over competition among the large conglomerates. The discourse of 'national competitiveness', however, appears to reduce those restrictions. 'Exclusive areas for small and medium size firm' have been reduced; 'designation of investment' has been deregulated and the 'restriction for debts' is now regulating only the top 10 large conglomerates, and it was announced that it would be fully abolished in the future. The 'deregulation' principle, for example, is applied to 'the special law for deregulating firms' activities', which reduces the regulation for safety of labour conditions and environmental duty (Lee, 1994). In addition, the principle of 'social stability' justifies the repression of political movement against the government policies.

7.3.4 Privatisation

The privatisation of public companies is one of the main economic reformation policy of Kim's administration. The strong government intervention has led to the establishment of a huge public sector. In many areas, the public sector of Korea plays a leading rather than a supporting role for the private sector. It is also worth noting that the public sector has been expanded in the process of centralising and directing all the social and economic sectors in Korea, but has largely neglected the social welfare system. For example, education and medical services remain largely individual responsibilities.

Privatisation of public companies, such as the railway, telecommunications, and electricity sectors, etc., has been discussed and practically being undertaken in the discourse of 'national competitiveness' to open the door to *chaebol*. This logic has been developed from the private initiative disputes that started in the 1980s. Privatisation has been discussed in different ways depending on the particular sectoral characteristics. However, the policy[26] of the new government adopted a wider scale and was implemented in accordance with the management reformation of public companies. The government confirmed that it would privatise 68 public companies during 1994 -1998.

---

[26]The Economy Planning Board announced the aims of privatisation as follows: 'Reforming economic structure', 'Improving efficiency of public companies', 'Reducing government's financial burden', 'Achieving more distributive effects', 'Developing capital market' and 'Expanding the scale of the stock market'. The principles of privatisation are 'a public auction' and 'assessing ownership'.

The process of privatisation has been criticised on the ground that the plan is focused on selling the government's shares to *chaebol* rather than on showing how privatisation achieves efficient public companies and how it relates to reforming economic structure.

> The privatisation is being undertaken to add more dishes for '*chaebol*' ... it's just the process of betting with money and getting money... the weight of public companies within domestic economy is not light. The added value of public companies is 9.4% of GDP, and they are strongly related to the other industrial sectors. The policy of privatisation, however, is being undertaken without concerns as to the related effects with the other industrial sectors, social welfare system and the market conditions. Above all, the clan management system of '*chaebol*' still largely exists. The privatisation policy, in the name of improving efficiency of public companies, is just creating private monopoly transformed from public sector, replacing public monopoly (Representatives Committee of Public Sector Trade Union, 1995: 25).

Whereas the public sector in the western society has been established in relation to the social welfare system, the public companies in Korea have been established to accelerate economic development by strong government intervention. However, it is still true that the public sector is closely linked with people's lives and it has been expanded by people's tax. The criticism outlined above is made on the grounds that pursuing efficiency in the public sector is not necessarily the best measure of the value of public companies; the highly profitable public companies are likely to be transferred to '*chaebol*', which is able to afford to acquire the stocks of the public companies in the Korean economic structure. Privatisation is being pursued, but it reflects the economic interests of *chaebol* in the changing domestic economic circumstances.

7.4 Summary

The 'authoritarian developmental state' has a high profile in terms of state's autonomy in the developmental process in the Korean context. The state autonomy embodies class-biased policy directions, both politically and economically. The peculiar feature of capital in Korea, '*chaebol*', was formed in the process of economic development, which resulted from the state's initiative in providing a privileged environment for selected capital. This phenomenon was caused by the condition of a lack of capital accumulation, which occurred in the nineteen century in western society, and which was distorted by Japanese imperial colonialism in Korea. The state exerted the power to distribute the resources and foreign debt that was available to approved companies.

Chaebol do not need government's approval or its distribution of resources any longer. However, it still pursues a privileged environment and now prefers the competitive market and deregulation in many areas rather than control and regulation which used to create a protective environment for it. Power shifts between state and capital are emerging for the very reason that successful capital accumulation was carried out, initiated by government intervention. Liberalisation and privatisation of the public sector has been pursued since the late 1980s and is flourishing in the 1990s with the notion of national competitiveness. The transition of telecommunications occurs under these circumstances, and it is likely that liberalisation and privatisation of the telecommunications industry responds to *chaebol's* demand for expanding its business realm. And this is dealt with in chapter 9.

Chapter 8: The Telecommunications Industry in Korea

8.1 Introduction

This chapter provides a background for understanding the telecommunications industry in Korea. This background considers brief history of telecommunications development (8.2); the main players in the telecommunications sector (8.3); the telecommunications service market and R&D system (8.4); and network conditions (8.5). Features of the transition of telecommunications in Korea is examined in chapter 9, reflecting internal and external elements which shape it.

8.2 Brief History of Telecommunications Development

The Korean telecommunications industry began with the telegraph in 1885 and has evolved into one with a network covering the whole country, competitive market segmentation and a variety of services.

The development of telecommunications in Korea can be split into four phases: early development - until the 1960s; demand for basic facilities - 1970s; explosive extension of facilities and the separation of regulation and operation - 1980s; restructuring of the market -1990s. This subsection looks at a brief history of telecommunications development in Korea using the above sequence; and chapter 9 examines the restructuring of telecommunications since the beginning of 1991 in greater detail.

Korea has an over one hundred year old history of telecommunications services. This history underwent discontinuity caused by the Japanese imperial colonial period (1910-1945), the separation of the Korean peninsula (1948- present) and the Korean War (1950-1953). Telecommunications facilities during the colonial period were constructed in a way which served the Japanese colonial sovereignty. The Korean war destroyed even the residues of the colonial facilities. Distorted and destroyed telecommunications facilities, like other damaged infrastructures of the country through the colonial period and Korean War, have been reconstructed through the process of industrialisation (see section 7.3).

In relation to the social and economic basis of Korean society, transportation and telecommunications have been regarded as important sectors in governing the country. The investment in the facilities of transportation as a basic infrastructure of economic development became intensive in the 1970s, while those of telecommunications began to undergo investment in the 1980s. The condition of a divided nation has required the formation of a complete telecommunications network in the case of an emergency (war). Therefore, the early development of telecommunications infrastructure was undertaken mainly for the purpose of responding to the demand for defence facilities.

Until the 1970s, the telecommunications operations largely relied on foreign companies such as RCA and AT&T because of the weak base of domestic telecommunications equipment manufacturing. The Government, which played the dual role of policy maker and operator, chose to use high-quality foreign equipment; and private companies were also likely to import foreign equipment rather than to invest in manufacturing.

Since the economic development started, the significance of telecommunications was also recognised, and full investment was initiated. Telephone switching facilities increased from 120,000 circuits in 1961 to 1.7 million in 1977 after the consecutive Five-Year Economic Development Plans began in 1962.

In the early 1980s, Korea Telecom Authority (KTA) was established with the role of operation, separated from the role of regulation of the Ministry of Communications (MOC). KTA has provided basic voice services monopolistically. MOC postulated as its policy aims, 'Immediate Telephone Installation System', 'Widening and Automation' and to realise the slogan 'one home, one telephone'. From 1981 to 1987, an average of 1 million telephones per year were provided. By 1987, the subscription for telephones covered all the districts in the country.

During this period, steps were taken to modernise Korean telecommunications technology in order to increase self-sufficiency as well as to extend the range of facilities and services on offer. Korea began to go beyond the simple assembly-formed production of semiconductors as subcontractors or off-shore assemblers for leading firms in developed countries. Local firms started producing VLSI circuits (1MDRAM, 1MROM, 4MDRAM), and are now competing with similar firms in developed countries. The Time Division Exchange (TDX) switching system[27] is a product representative of indigenous technology, and resulted from the collaboration between a public institution and large competitive companies (see section 8.4). The development of diverse technologies and services such as fibre cables, satellites,[28] microwave and so on, and CATV[29] have been undertaken in preparing for ISDN beyond the 1990s.

At the juncture of 1990 policy reform, the Korean telecommunications industry has entered into liberalisation and competition. The decision does not necessarily mean that the condition of the industry is healthy enough to survive in the competitive market with a well-developed technological basis. However, there have been changes and an evolution of the industry which can be considered as rapid expansion and development.

8.3 Telecommunications Sector: The Players

A government-owned authority used to be the monopolistic provider of the Korean telecommunications service for many years. Through the 1980s, diversification of the structure of actors emerged, and this diversification has become far more complicated in the process of introducing competition. In this section, I introduce the main players with respect to regulator, main network operators and R&D institutions.

---

[27]KT, in association with several manufacturers and ETRI, developed and began to install an indigenous exchange system called TDX-1, with capacities of 100, 000 subscriber lines and 60, 000 trunks, and maximum traffic handling of 26, 000 Erlang and 1, 200, 000 BHCA.

[28]In 1995, Korea for the first time launched two satellites called Koreasat consisting of 12 channels for communications and three for broadcasting. The project, which costs about US $400 million, is expected to encourage state-of-the art technology in the fields of satellites, launch vehicle and control facilities, and terrestrial equipment in Korea. Based on technology transfer from the participating foreign companies (to select a manufacturing consortium in first stages), the second generation of Koreasat is expected to be provided domestically.

[29]CATV channels have been operating since 1991. CATV is capable of carrying more than 20 channels on the VHF spectrum using a converter by which users can select the frequency spectrum and up to 108 channels if the UHF spectrum is included, whereas regular TV broadcasting (the existing TV channels are KBS 1 and 2, MBC, SBS and EBS) has a transmission spectrum of 6MHz per channel and space between channels of 12MHz. CATV is also capable of two-way transmission owing to the development of electronic technology and the computer.

The Ministry of Information and Communications (MIC)[30] retains the dominant power over decision making in telecommunications policies, playing roles in establishing policy direction, regulating the industry, and issuing licenses. The MIC set up Korea Communications Commission (KCC) in March 1992. KCC plays roles in raising funds for various purposes including improving telecommunications facilities and performing R&D projects; licensing carriers; and securing optimal competition to protect users, and so on.

Common carriers in Korea are now rapidly diversified in the process of introducing competition both in the existing service areas and in the emerging new service areas adopting new technologies. The main common carrier is Korea Telecom (KT),[31] which was created as a public enterprise, wholly owned by the government in 1982. The privatisation of KT has been undertaken to the extent that some government shares are sold, but full privatisation is still in dispute (see section 9.2.4). Facing privatisation and rigid competition, KT has modified its business structure by reorienting the organisation towards a profit-based system, focusing on strategic technical development (including the early construction of ISDN), introducing customer-oriented management, and supplying new value-added services in addition to the basic voice telephone services.

If we look at the status of Korea Telecom in the world telecommunications market, it ranks at number thirteen (Table 8-1). Although Korea Telecom ranks rather highly compared with other carriers, its international performance is still low as its turnover mostly comes from domestic service provision.

DACOM was formed in 1982 on the back of both public and private investments. DACOM mainly plays a key role in supplying information and value-added services to private subscribers as well as the government and many other public institutions. It became a main competitor of Korea Telecom in the service areas of international and long-distance telephone services.

---

[30] Previously, MIC was called MOC (Ministry of Communications) until the beginning of 1995. I will mostly refer to MIC for this organisation in this thesis unless it is necessary to call it MOC in terms of specific period of its activities.

[31] KTA(Korea Telecom Authority) changed its title to KT in 1991.

Table 8-1: Korea Telecom's Status in the World Telecom Market in 1995

(Unit: 1 million US $)

Carriers	Turnover	International Revenue	International Traffic
AT&T	47,277	10,164	8,462
DBT-T	46,200	7,154	5,244
France Telecom	30,222	4,432	2,843
BT	22,052	3,022	2,909
Telecom Italia	18,966	1,662	1,890
MCI	15,265	3,434	4,458
US Sprint	12,765	1,389	1,765
Telstra	11,921	1,311	807
Telefonica	11,314	1,189	1,025
Stenor	10,500	1,410	1,490
China Telecom	10,022	740	1,339
Swiss Telecom	9,131	1,683	1,778
Korea Telecom	8,562	706	425
PTT Telecom Netherlands	8,498	1,503	1,422
C&W	8,422	3,908	n/a

(Source: *Communications Week International*, 25 November 1996)

In mobile communications, SK Telecom was initially established by both public and private investments (KT 65.1%, others 34.9%) in 1984 to provide mobile telephone and paging services under the name of KMTC (Korea Mobile Telecommunications Co.). It became privatised in 1994; the name was changed to KMT; and the major shareholder is *Sunkyung*. Then, in 1997, the name was changed to SK Telecom, a company with a strong commitment to expanding its business areas beyond mobile cellular provision. *Shinsegi* Telecom was granted licences as the second mobile operator competing with SK Telecom in 1994 and it started service provision in 1996 using a digital system.

In addition, Korea Port Telephone Co. (KPTC) was established in 1985 to provide communications services in harbour areas and Korea Travel Information Services Co. (Kotis) was established in 1987 to provide value-added communications services for travel. Korea Telecommunications Authority International (KTAI) is a limited company established in 1986. As a subsidiary of KT, it supports efficient investment in telecommunications and overseas expansion of domestic telecommunication services through the development of engineering and operating techniques.

With respect to R&D institutions, considering the fact that several large companies operate their own R&D laboratories, the public sector has still been playing a vital role in R&D activities in Korea. The private laboratories are getting powerful enough to develop the technology with efficient investment and flexible management. One distinct trend is that since the middle of 1980s, scientists and engineers now prefer private laboratories to public institutions.

The Electronics and Telecommunications Research Institute (ETRI), established in 1975, is a government-sponsored research institute which undertakes national R&D on advanced information technologies, integrating the areas of telecommunications, computers, automation and semiconductors. It used to be supported by the Ministry of Science and Technology. In 1992, ETRI started to be supervised by the MIC. ETRI has been providing technical assistance to telecommunications industries. It has also been helping to foster technical development by transferring technology to private industries for mass production. ETRI has played a role as a centre of R&D collaboration between private companies. In consequence, it has so far obtained a number of industrial property rights such as the R-2 receiver technology for TDX-1. The Korea Information Society Development Institute (KISDI), established in 1985, is also a government-sponsored policy research institute. It mainly takes social science perspectives, especially with regard to government policy, in four main areas: telecommunications, information and communications, radio and new media, postal and postal finance policies. Through publications, it also provides private companies as well as public institutions with analytical information. It plays a role in supporting relevant research in academia, funding and evaluating projects on behalf of the MIC.

The National Computerisation Agency (NCA), established in 1987, is mainly engaged in the development of technology and equipment related to computer networks and in standardisation of the technologies. It has played a role in designing and operating the 'National Computer Network' for the government and public organisations, and it is now one of the main players involved in Korea Information Infrastructure (KII) by leading the 'national information network' construction within KII (see sections 10.2.2 and 10.3.2).

In addition, if we briefly look at the private sector, it is difficult to make distinct boundaries in the 'telecommunications industries', owing to its complex nature and the emergence of the convergence of technologies with other industries. In general, service providers and manufacturers of equipment and network elements are regarded as the players in the telecommunications industry.

Influenced by liberalisation, the boundary between manufacturing companies and service providers became blurred. There used to be a type of division of labour between private sector and public sector in telecommunications, as manufacturers and service providers respectively. The liberalisation now enables manufacturers (as well as large users) in the private sector to enter service markets as providers (see section 9.2.3).

8.4 Telecommunications Service Market and R&D Systems

The Korean telecommunications industry has the same level of basic telecommunications services as advanced countries in general; but, on the whole, it lags behind. For example, although the Korean telecommunications industry is producing equipment such as TDX and TICOM (the title of the state of the art computer workstation), it is vulnerable in the field of key technology capability on high performance computer and high technology equipment. "Because telecommunications in Korea has been developed in the way which puts first telephony, the advanced telecommunications for transmission, accumulation and processing of multimedia information has lack of competence. Korea also has lack of public database systems, conveyed by information flow systems [network]. Korea needs systematic industrial policy which contains information service, equipment and software on the basis of information network" (KII Task Force, November 1994).

Korea is graded in the second category of telecommunications development according to an evaluation carried out by the Financial Times, with Taiwan, Malaysia and Thailand, which have already instituted reforms and whose telecommunications provision is to some extent matched by their economic activity. It is noted that "what they need is not finance from abroad so much as expertise to help develop their networks and then use them properly. Some have ambitions - in multimedia, for example - which are not justified by their economic development" (Financial Times, 9 May 1995).

At the end of 1993, the number of Korean telephone circuits reached over 20 million, opening the 'one home - two telephone era'. The network facilities have met the demand for basic service, and the network digitalisation achieved up to 100% of long distance calls, 95.9% of local calls, and 87.5% of international calls in 1993. Korea ranks second in Asia in terms of network facilities and holds the eight largest telephone network in the world.

The Korean telecommunications sector showed an annual growth of 19.3% during the period 1983-1987, while the annual growth of GNP in the same period was 10%. The telecommunications service market grew rapidly with an average of 23% during the period 1990-1994 (Table 8-2).

Table 8-2: Telecommunications Service Market in Korea

(Unit: 1 million US $)

Sector	1990	1991	1992	1993	1994
Network	4,258	4,922	5,388	5,904	7,099
Value added	82	120	183	275	324
Total	4,340	5,042	5,571	6,179	7,423

(1$= 707 Won in 1990; 733 in 1991; 781 in 1992;803 in 1993; 803 in 1994)

(Source: KISDI)

Telecommunications services are divided into two categories of the present market segmentation in regulation: network services and value added services. The former requires licences granted by MIC and the latter enters the market by first notifying the MIC. The telecommunications service market is mainly monopolistic or duopolistic, but it is being changed into full competition (see section 9.2.2).

The Korean Government and private industry spent a total of 5,000 billion Won (£ 4 billion) on R&D in 1992. This ranks at the top for developing countries in the amount and percentage of GNP spent on R&D. The Government wants to raise R&D spending to 5 per cent of GNP by the end of the decade from 2 per cent at present.

Table 8-3: Telecommunications Manufacturing in Korea

(Unit: 1 million US $)

classification	1990	1991	1992	1993	1994
Production	2,376 (622)	2,633 (704)	2,841 (764)	3,010 (985)	3,255 (1,292)
Domestic use	1,817 (451)	2,041 (653)	2,207 (774)	2,346 (975)	2,880 (1,435)
Export	1,115 (410)	1,529 (663)	1,380 (471)	2,727 (571)	1,757 (773)
Import	557 (239)	657 (357)	749 (481)	894 (561)	1,382 (916)
Rate of import dependency	30.6% (52.8%)	32.2% (54.8%)	33.9% (62.3%)	38.2% (57.7%)	48.0% (63.8%)

*Figures in brackets indicate the wireless sector
(1$=707 Won in 1990; 733 Won in 1991; 781 Won in 1992; 803 Won in 1992 and 1993)

(Source: rearranged data from KISDI, 1995)

Manufacturing in telecommunications has been mainly developed to satisfy internal needs from the domestic operators, particularly Korea Telecom, unlike the situation in other electronics manufacturing sectors such as consumer electronics, computers and semiconductors, which are export-oriented. The telecommunications manufacturing sector, however, is not growing as rapidly as the telecommunications service market. It shows a 15.9% of growth rate since 1990 (Table 8-3). In particular, as indicated by Table 8-3, import dependency in the wireless sector is far greater than the average.

The heavy domestic reliance for manufacturing has been made possible through institutionally supported R&D systems in the linkage between production and procurement. The existing R&D activities in the telecommunications sector have had the clear distinction of committing support for domestic manufacturing through technological support from ETRI, financial support from common carriers through ETRI, a demand forecasting system and a quality assurance system, and guaranteed procurement. It is compulsory for the network service providers to contribute R&D expenditure from a specific portion of their turnover (at present, 7-9%) by law, and the portion will be increasing up to 10% by the year 2000. The common carriers have used this linkage between R&D and procurement in purchasing major innovative equipment. In this R&D chain, ETRI has had stable funding for R&D and manufacturers have had a stable market.

With the policy to protect domestic manufactures, the indigenous switching system, Time Division Exchange(TDX) series was developed and installed approximately 2.6 million circuits in the domestic market (1978 - 1991).[32] TDX development has brought about the substitution of importing telecommunications apparatus and a momentum for improving telecommunications technology overall. The Code Division Multiple Access (CDMA) system for mobile communications was also developed and installed in the existing R&D scheme, which will be dealt with as a case study in this thesis.

Hobday (1991) estimates the developmental level of technology in Korea,[33] pointing out the fact that Korea has made major strides towards the development of TDX, semiconductor inputs, optical communications and ISDN software. In fields such as narrow-band ISDN, hardware design for public exchanges, private exchanges for voice and data, satellite

---

[32] Owing to the immense versatility of the TDX systems, they have been widely accepted in foreign markets including countries like China, the Philippines, Vietnam, Nicaragua, Iran, Russia and Poland. According to communications officials, concentration on research and development rather than world-wide marketing has hindered penetration of foreign countries where distribution is just beginning. The excellence of the quality of the systems, as tested rigorously in foreign authorities, has allowed related manufacturing companies to at least launch a bid to gain a greater foreign market share (Korea Times, 5 March 1994).

[33] Korea lags behind the market leaders in the following areas: broad band ISDN exchange R&D; ASICs for public exchanges; design and software automation for exchanges; network integration into LAN equipment; voice, data and video integrated exchanges (private); broad transmission; optical subscriber systems; protocol conversion; digital microwave; satellite system design; mobile system design and production; VLSI for mobile communications; high performance teletex design; videotex standards; high performance videophone. In several cases, such as optical transmission, digital microwave, and facsimile, Korea is only one generation behind the world leaders (Hobday, 1991: 96).

operation and maintenance and teletex manufacturing, "Korea is on a par with the world leaders" (Hobday, 1991: 96).

8.5 Network Conditions Towards B-ISDN

Network is the most critical factor with respect to establishing information infrastructure to provide high-quality services, although development of the other sectors of the information communications industry needs to meet a certain high-quality level.

Since the 1980s, when digital telecommunications technology was being developed, facsimile and personal computers were taking off and the demand for data communications and information services was increasing, Korea Telecom established its N-ISDN (Narrow band ISDN) plan on the basis of the existing PSTN (Public Switched Telecommunications Network) facilities. The development of technology for fibre optic cable and communications means not only high speed but also the capacity of a complex and systematic network. This allows users to enjoy every service, instead of the concept of individual networks providing individual services. The plan for an information highway can be realised with the evolution of networks.

This section introduces how the telecommunications network has been constructed and what Korea Telecom has planned and achieved in this area. This also provides the pre-history of the KII programme, a case study of this thesis. The contents of this section are divided into two parts; first, digitalisation; second, improving network function towards ISDN and commercialising ISDN.

Korea Telecom has sought to develop its plan for digitalisation of the network, to ultimately realise B-ISDN in the future. Digitalisation is divided into three sectors: digitalisation of switching system, digitalisation of transmission facilities between local and long distance service, and digitalisation of subscriber loop network. In the case of the subscriber loop, Korea Telecom is found to have an established digitalisation plan in 1988 (Table 8-4). If we look at the progress of digitalisation until 1988, whereas 100% of long distance exchange systems and 66% of transmission facilities had been digitalised, digitalisation of the subscriber loop had not been introduced. The digitalisation of subscriber loop was problematic not only in terms of availability of technology, but also in terms of limitation of investment because the portion of the subscriber loop covers 40% of the total resources for investment.

Korea Telecom was still uncertain about the future benefit derived from digitalisation of subscriber loop in 1988: "... however, the main demand of telecommunications are telephone service, which probably continues in the future; and, there is a prediction that demand of digitalisation will not be over 10% of total demand in 2000, so that it is more important to have a long term plan to improve network performance depending on the future demand" (Korea Telecom, 1988: 10).

Table 8-4: Plan for Digitalisation of The Facilities of Exchange and Transmission[34]

(Unit: %)

Section		1991	1996	2005
Local	Exchange	47	69	100
	Transmission	90	100	100
Long	Exchange*	100	100	100
Distance	Transmission	86	100	100

* completed in 1984

(Source: Korea Telecom, 1988)

Narrow-band ISDN, seen as a stepping stone to B-ISDN, can be realised by adding various functions on the existing PSTN, which can be performed with limited number of connection types and multiple user- network interfaces. In comparison, broad-band ISDN is expected to provide high speed performing data, text, image, program, etc., in addition to narrow-band ISDN services. The most critical condition for construction of B-ISDN is to introduce a suitable transmission system capable of providing broad-band and high speed for transmission of communications services. It was suggested that the subscriber loop copper

[34]-Removal of mechanical exchange system: by 1995
- Substitution of fibre optic for trunk line : from 1993
- Managing network in European transmission mode: from 1991
- Substitution of digital mode for analogue mode: from 1993

cable was also to be changed to fibre optic cable so as to provide broadband services. It was not definite how much broad network functionality would be needed, because it depends heavily on the level of services. Korea Telecom predicted that 600 Mbps (speed) and 2.2GHz/Km of bandwidth should be satisfactory to provide the level which includes 4 channel for simultaneous image transmission, two FM channels and several channels for voice and data transmission (Korea Telecom, 1988: 17). The advanced plan predicted that, up to 1996, 20% of subscriber loop would be digitalised, based on demand and ISDN services. It also indicated that the provision of fibre optic cable to large buildings and companies would be given priority (Korea Telecom, 1991).

According to the basic plan (Korea Telecom, 1990), the initial stage (1987 -1991) includes establishment of ISDN infrastructure, introduction of the No.7 signal mode, network digitalisation and establishment of a technology standard. Second, the introductory stage (1992 - 1996) includes completing the digital network infrastructure, realising the state of the art ISDN function, launching the commercial service (1994), accomplishing broad-band ISDN technology. Finally, the expansion stage (1997 - 2000) includes constructing nation-wide ISDN, gradual integration of packet network and telex networks and introducing broad-band ISDN.

The 1991 pilot service plan was set up with the new title of "Hanaro" (meaning: towards one). KT identifies "Hanaro" as Korean-type ISDN which will "be realised by the TDX switching system" and has the expectation of "preparing open-market conditions through standardisation of network using state-of-the-art technology" (Korea Telecom, 1991: 7).

When the plan was established, it was clear that it should pursue "establishment of infrastructure for the information society with state-of-the-art technology." KT made an investment plan for technology development, setting aside 176 hundred million Won in the period 1985 to 1990, and 360 hundred million Won from 1991 to 1993 (equipment and transmission: 60 hundred million Won, ISDN switching system: 180 hundred million Won, No. 7 signal network: 120 hundred million Won); and 185 hundred million Won for pilot services.

KT expected ISDN service demand to be 2,300 subscribers in 1995 and 2.5 million in 2001, which is based on the assumption that three or four times more demand would occur once commercial service had been initiated. However, it turned out that the subscription for ISDN service, which started in 1993, reached less than 10,000 in 1996.

8.6 Summary

The telecommunications service sector has been rapidly growing, especially in the 1990s, and it has become diversified in terms of market structure in the process of introducing competition. The stable R&D chain, based on the linkage between production and procurement, promoted the telecommunications manufacturing sector in Korea. Future telecommunications development in Korea no longer involves meeting demand for basic telephone services. Rather, it involves improving network facilities to provide advanced services through the construction of B-ISDN.

Chapter 9: Telecommunications Restructuring in Korea

9.1 Introduction

The transition currently taking place in telecommunications reflects the way in which a particular social context may encourage new institutions and technologies to emerge, even as it is being shaped by global conditions. This thesis examines the particularity of the Korean context by looking at the two sectoral cases, the Korea Information Infrastructure and the Digital Mobile System Development. The former deals with a network evolution programme initiated by government, and the latter examines a technology development in the mobile communications area driven by the market. Those two cases are presented in Chapters 10 and 11.

This chapter examines the current issues, changes and challenges in the telecommunications industry in Korea. It is based on the features and history of the industry presented in the previous chapter. First, it examines the restructuring of the telecommunications market and the changing role of the PTO (9.2); second, the changing technology development system (9.3); and third, the current debate surrounding universal service in Korea (9.4).

9.2 The Changing Telecommunications Market and Its Challenges

An open market environment is a significant factor for the changing telecommunications market in Korea. On the one hand, the telecommunications sector cannot escape from the situation where the Korean economy becomes exposed to foreign direct investment and sales in general. On the other, the open market policy in telecommunications also applies to the internal market which has previously been protected from the market principle. This section examines the restructuring of telecommunications which arises from this basic environment by looking at open market (9.2.1); introducing competition (9.2.2); the linkage between services and manufacturing (9.2.3); the changing status of Korea Telecom (9.2.4); exclusion of opposition group (9.2.5).

9.2.1 Open Market

The open market concerns were based on the bilateral Korea-US telecommunications talks, and the multilateral Uruguay Round, WTO (World Trade Organisation), and NGBT (Negotiation Group on Basic Telecommunications). The open market in telecommunications lies in the continual line of open market pressure on the other areas. Since the beginning of the 1980s, the US took steps to impose an opening up of the market in the areas of crops, services and capital. The WTO, launched in 1996, is pursuing open market competition in world trade markets with the legal commitment and power to govern the new trade order. The WTO succeeded from GATT (General Agreement on Tariffs and Trade) which had been pursuing the liberalisation of trade on the basis of multinational agreements rather than legal constraints.

The Korea-US talks took place between September 1989 and February 1990, resulting in a fully open market for the simple database and data processing industry from July 1990, allowing foreign participation in the process of standardisation, relieving type approval of telecommunications apparatus, and opening the procurement market. The USA, in fact, demanded a fully open service market apart from the monopolistic and regulated service in Korea, which was mainly interested in the area of VAN (Value Added Network) services, and which came to be fully opened in January 1994.

The multilateral negotiations towards the liberalisation of basic telecommunications services were scheduled to begin in 1994. The talks resulted in a wide range of service markets being opened up, mainly in value added services, leaving the area of basic telecommunications services with NGBT. The talks of NGBT were supposed to end in April 1996, but they were postponed till 15 February 1997. The most critical points of the talks are: allowing entrance to the market by means of withdrawing restrictions on foreign participation and restrictions on the number of providers; creating a fair competition environment with respect to institutions and the fair interconnections between them, and a transparency of regulation with the establishment of an independent regulatory body; and lifting of undue discrimination in allocating radio frequencies and numbers. Under the influence of NGBT, the restriction of foreign ownership is expected to be lifted gradually, permitting full competition on a global scale (Cho et al., 1996).

Korea also submitted the first 'Offer Lists' with a commitment to provide licences to network operators, once they can meet the conditions of satisfying the technology standard; of making the radio frequency available; of capturing less than 33% of foreign share, and, for service providers, of interconnecting the public-private network from January 2001 (MIC, Press Release, 12 December 1995). With respect to foreign investment, the basic telecommunications services are restricted whereas there is no restriction in value added services. Eventually, however, NGBT would no longer permit any restrictions.

The open market environment is largely assumed to enable the introduction of competition and liberalisation into the market for telecommunications. A responsible member of staff in DACOM,[35] sees the restructuring of the telecommunications market coming from preparation to open up the market.

> The policy focus starts from preparations to open up the market. I think the basic perception of the government is two-fold: first, that opening up the market is inevitable; and second, that, before foreign companies enter the market, government has got to create an environment within which domestic providers hold the market. This year [1996], the Government selects twenty seven new service providers.[36] It's certainly an event which foreign observers of our country would be surprised at. There will be another event sometime late this year or early next year. (Jung, Tae-Chul, 24 June 1996)

There is certainly fear of the open market as people do not see sufficient competitiveness within the Korean telecommunications sector. The interviewee continues:

> The open market will come in 1998. Well, even if we open up the market, it will take time for foreign companies to launch their services fully. In fact, the most critical areas are resale, internet calls, and call back services, which, I believe, will spread quite rapidly. (Jung, Tae-Chul, 24 June 1996)

The competitive areas are mostly related to service provision rather than network operation. Foreign competitors could easily launch their services in the sales areas of the telecommunications market given their expertise in marketing and value-added services rather than in network operation, which requires heavy initial investment. The introduction

---

[35] DACOM is a major competitor of Korea Telecom in the areas of international and long distance telephone service (see section 8.3).

[36] Selecting twenty seven service providers is sensational in that the existing network operators and service providers are a very small group which includes Korea Telecom, DACOM, SK Telecom, and *Shinsegi* Telecom. The new service providers will be launching their services mainly in new areas of telecommunications, as well as in some existing areas of the industry.

of competition has already been extended to local telephony reflecting the outcome of NGBT's decision.

The next section examines the features of introducing competition which has been taking place since 1991, reflecting the push towards an open market environment.

9.2.2 Introducing Competition

The telecommunications industry in Korea has been changed drastically with 1990 as its turning point. The Government postulated the slogan 'First, open up the market internally, second, open up the market externally'. Introducing competition has been undertaken in a three-stage substantial restructuring over five years, and is now including introducing infrastructural competition.

The first steps were taken in 1990 in the areas of value added services and international telephone services. Korea Telecom began to compete with DACOM in providing international telephone services in 1991.[37] In order to establish a proper regulatory scheme, service providers were classified into two types: Network Service Providers and Value-added Service Providers. The Network Service Providers were again divided into General Service Providers and Specific Service Providers. This classification is the basis for how competition is gradually introduced.

In 1994, the next steps were taken to introduce more competition to the area of long distance telephone calls. The classification of service providers was also changed: the distinction between General Service Provider and Specific Service Provider within Network Service Providers was lifted to accommodate newly emerging technologies such as PCS (Personal Communications Services) within the telecommunications infrastructure. In the area of basic telephone services, the ownership of carriers is restricted to an individual share

[37] The competition in international telephone service was rather radical because Korea Telecom and DACOM used codes 001 and 002 respectively. If we look at competition in the UK international telephone market, customers used to have to avail of additional terminals in using services provided by Mercury. Even now, customers need additional numbers for using Mercury's services rather than simply using different codes. DACOM expanded its market share quite rapidly through cheaper tariffs as well as having the advantage of its own code.

of not more than 10%, while foreign ownership is not permitted. The government still generally supports the public ownership of basic telephony.

The third step, taken in 1995, is rather shocking in the sense that the MIC announced its intention to secure full-blown competition in most areas (Cho et al., 1996). Thus, new licences were issued to 30 carriers in 1996, in the areas of newly emerging services such as PCS, TRS, CT-2 and wireless data communications, as well as the introduction of further competition in services such as international telephony, paging and leased lines with the exception of local telephone services. Consecutively, competition in local telephone services was introduced in 1997 by selecting a second local telephone service provider, *Hanaro* Telecom and by establishing 'super-highway carriers' (see section 10.3.4). Table 9-1 summarises the structure of competition reflecting market scale.

Telecommunications restructuring in Korea is highly determined by open market conditions. However, there is a strong internal need both for private participation in the industry and for efficient access to sophisticated telecommunications services. I would like to focus on the need for private participation in this industry. Table 9-2 shows *chaebol*'s participation in the current telecommunications service market.

The introduction of competition in 1996 was largely applied to wireless communications rather than fixed line services. One reason to introduce full competition in wireless communications is that the Government distributes radio frequencies, a limited resource to domestic providers prior to opening up the market. Unless new technology is developed to make use of frequencies more effectively, there may not be any available to foreign companies.

Wireless communications require less initial investment and have more potential for growth than fixed line services. It is a highly profitable area and so existing telecommunications carriers and new providers are eager to claim a stake as quickly as possible. The interviewee in DACOM describes the matter in relation to DACOM's interests:

> Until 1993, we had higher turnover than KMT, but now it's the reverse. KMT's turnover target this year is 160,000 million Won; for DACOM, it is 65,000 million Won. Last year KMT's turnover reached 100,000 million Won whereas DACOM's

Table 9-1: Structure and Scale of Telecommunications Service Market

(Unit: 1 million US $)

Classification		Market structure in 1997*	Market structure prospects in 2000	Further Detail	Turnover	
					1995	1996
Network	Local	•KT Monopoly	• KT • Second carrier • Super-highway carrier	• June 1997, the second carrier was granted (*Hanaro*) • KII construction	3,615	3,767
	Long distance	•KT •DACOM (1996)	• KT •DACOM • Third carrier • Reseller	• June 1997, the third carrier was granted	2,311	2,651
	International	•KT, •DACOM (1991)	• KT •DACOM • *Onse* Telecom • Reseller/ Call back service provider	• Global carriers will enter soon •*Onse* Telecom (1998)	1,023	1,268
	Mobile Cellular/ PCS**, CT-2, TRS***/ Paging	Cellular: •KMT, •*Shinsegi* (1996) Paging: •KMT •10 local based providers	• Full competition among cellular, PCS, CT-2	• New licences in 1996 for PCS (KT, *Hansol, LG*)/ CT-2 (11 units)/ paging (1 more)/TRS (6 units) / wireless data (3 units) • One more new licence for paging in 1996	2,218	3,819
Value	added				519	594
Total					9,687	12,117

* Carriers who actually provide services at present are listed; the newly licensed carriers are explained in 'Further Detail', ** PCS: Personal Communications Services, ***TRS: Trunked Radio Services ($1=771 Won in 1995; 1$ = 820 Won in 1996)

(Source: rearranged data from KISDI)

Table 9-2: *Chaebol's* Participation in The New Telecommunications Services

Classification (number of operators)	Main Network Operators	Service Areas (year of licence granted)	Shareholders
Telephone(4)	Korea Telecom	Local, Long distance, International	Government/ People
	DACOM	International (1991), Long distance (1996)	1) *Hyundai*/ LG/ *Dongyang*/ *Samsung* 2) *Daewoo*
	Onse Telecom	International (1996), Long distance (1997)	1)*** *Hyundai* /*Lotte*/ *Gohap*/*Iljin*/ *Haitai*/*Kumkang*/*Hanla*/ Asia Cement/ *Daeryung Jungmil*/ Korea Electronics****
	Hanaro Telecom	Local (1997)	1) *Samsung*/ DACOM/*Hyundai*/ *Daewoo*/ *Turu* Net 2) *Hanwha*/LG/ SK Telecom
Wireless	SK Telecom	Cellular/ Paging	1) *Sunkyung* 2) Korea Telecom
Cellular (2)	*Shinsegi* Telecom	Cellular (1994)	1) *Kolon*/ *Pohang* Steel Co. 2) Korea Electronics/ *Samsung*/LG/ *Hyundai*
PCS (3)	KT Freetel	PCS (1996)	1) Korea Telecom***** 2) *Daewoo*/ *Hyundai*
	LG Telecom	PCS (1996)	LG
	Hansol PCS	PCS (1996)	1) *Hanwha*/ *Ssangyong*/DACOM 2) *Anam* Telecom
Paging(12)*, CT-2 (11)**	*Narae* Mobile Telecom	Paging (1992), CT-2 (1996)	*Sambo* Computer
TRS (7)	*Anam Telecom*	TRS (1996)	1) *Ssangyong* 2) *Hansol* PCS/ *Hyundai*
	Korea TRS	TRS (1996)	1) Korea Telecom****** / *Hanbo* 2)*Hanwha*
Others	*Thru* Net	Leased Line (1996)	1) *Sambo* Computer/ Korea Electronics

1) 5-10% of shareholding in the case of fixed network operators and 10-30% of shareholdong in the case of wireless network operators; 2) 1-5% of shareholding in the case of fixed network operators and 5-10% of shareholding in the case of wireless network operators

* SK Telecom included, ** Korea Telecom included, *** Although there are a number of shareholders, it is said that *Hyundai* is practical dominant shareholder as some of companies have close relationship with *Hyundai*, **** Korea Electronics is a government owned company, ***** Korea Telecom's share: 33.3% ****** Korea Telecom's share: 89% (Source: rearranged data from KISDI, 1996)

> was 35,000 million Won. The data services market is not fully exploitable.[38] I guess it will be difficult even to make a profit from a multimedia services within five years, although people are talking about it a lot. We should have entered the wireless services market this year. But policy prevents us from launching wireless service provision within investment limits of 5%. It's absurd. Even now we should enter the wireless market. It seems difficult.[39] (Jung, Tae-Chul, 24 June 1996)

Wireless service provision, therefore, has become the area where capital's interests are highly exposed. The episode now described shows how this is happening in the process of introducing competition. A new mobile telephone service provider, called *Shinsegi* was selected in 1994, in order to compete with the existing carrier, KMT (Korea Mobile Telecommunications Co.). Foreign companies were permitted to participate in a consortium led by domestic companies. Competition was intensified by strong market demand.[40]

The selection process for the second mobile communications service provider took place in 1992, in fact, following the decision in 1991 to introduce competition; but that selection met with political failure. *Sunkyung*, one of a *chaebol* was preferred company given its satisfactory proposals for R&D investment and service provision. However, it faced strong criticism on the grounds of favouritism, because the head of *Sunkyung* is related by marriage to the president of the Government, Roh. *Sunkyung* eventually returned its licence and the selection process took place again in 1994.

In 1994, the second mobile communications service provider, *Shinsegi,* was chosen by the Federation of Korean Industries (FKI), a powerful association of *chaebol. Pohang Iron & Steel* Co. (POSCO), the world's second-largest steel company, and the *Kolon* Group, conglomerate with chemical and textile holdings split the 29% stake (i.e. the limited controlling stake),[41] priced at $145 million, with POSCO getting 15% and the right to manage the company. Ironically, when *Shinsegi* was chosen, KMT, a 64% state-owned

---

[38] DACOM was initially established to provide data services. Now it provides a videotex service called '*Chunlian*', domestic and international data transmission services as well as long distance and international telephone services.

[39] DACOM has currently been granted license for fixed radio service (1997).

[40] The primary reason for introducing competition in mobile communication lies in drastically increasing demands for services of better quality and at lower costs. There were 2,658 mobile telephone subscribers in 1984; this figure had increased to 166, 000 by the end of 1991. Similarly, there were 235 radio pager subscribers in 1982 and 850, 000 by the end of 1991.

[41] Four Top *chaebol* of *Daewoo, Hyundai*, LG and *Samsung*, have got 3% shares each. In addition, as many as 300 large and small domestic equipment suppliers are in line for shares.

monopoly cellular and paging service provider was privatised as is now under the same ownership as *Sunkyung*.

This sketch shows how the interests of capital penetrate in highly profitable markets and how the relationship between capital and state is being changed. It was rather extraordinary for the Government to give up its authority to select carriers. It can be interpreted that the Government chose to be subordinated by the *chaebol*'s money and power. After all, the selection process faced criticism in the public arena. Yoon, Dong-Yoon, the Minister of MIC at that time, responded as follows to the criticism in an interview with a newspaper:

> I do not think it was the best way to authorise FKI to select the second mobile communications service provider. I, however, took the second choice in order to make it possible to exercise the creativity of the private sector and to get a broader opinion, by giving the opportunity for autonomous arbitration. (*Seoul Economy*, 7 March 1994)

Competition is thus being propelled by the Government's intention to prepare for the open market and by the interests of capital to establish itself in a highly profitable market. The interviewee in DACOM comments on this, with emphasis on the open market environment:

> The Government does not think that KT and DACOM are strong enough to compete with the foreign companies. The Government has got to establish as many service providers as it can before opening up the market. And the large domestic conglomerates have massive interests in the telecommunications market. They think that if they do not enter into the telecom market now, they will fall far behind in the 21st century. It's a sort of obsession. That seems beyond MIC's control. The large conglomerates exert their power even in other government organisations. But I still place more weight on the Government's commitment to its own intentions. (Jung, Tae-Chul, 24 June 1996)

'Opening up internal market first' underlies telecommunications policy priorities for introducing competition. The restructuring of telecommunications took place in such a short period of five years time, and the contents of restructuring has been dramatic challenges for the Korean telecommunications industry in terms of fostering domestic carriers' capability in preparing open market. *Chaebol*'s participation is prominent in this process especially in the wireless telecommunications market. *Chaebol*'s participation, however, brought about a fundamental changes in the division of labour between manufacturing and service provision. The next section closely looks at this aspect.

9.2.3 The Linkage Between Services And Manufacturing

The telecommunications industry in Korea used to make a clear distinction in terms of ownership between service provision and manufacturing. Whilst service provision started in the public domain, manufacturing is the area where domestic manufacturers in the private sector (e.g. *Samsung*, LG, *Daewoo*, *Hyundai* etc.) have provided apparatus and terminals. In the initial stages of introducing competition, domestic manufacturers were restricted in their ability to hold shares in service provision - they were limited to 3% in the category of general service provision, and to 10% in the category of specific service provision (see section 9.2.2). In the early stage of introduction of competition, the dominant share-holders of the newly-licensed service providers, such as *Sunkyung* (KMT), *Pohang Steel Co.* and *Kolon Group (Shinsegi)* all come from the non-telecommunications apparatus manufacturers.

As competition is being enlarged, the limitations on share-holding are being repealed. In 1994, the law was changed to lift the restriction against the participation of manufacturers in the area of service provision. In 1996, the newly-licensed competitors mainly come from those manufacturers in the form of share-holders and owners. The major telecommunications manufacturers are mainly *chaebol*, such as *Samsung*, LG, *Daewoo*, etc.

This phenomenon highlights the need to review the existing processes of procurement and R&D provision. Once manufacturers become competitors of Korea Telecom, and of the several other carriers licensed in the initial stage, the R&D contributions and guaranteed procurement by these carriers became problematic.

Meanwhile, entry into manufacturing from the service providers' side is still restricted. A member of staff in Korea Telecom argues that the company should expand its domain into manufacturing:

> Our competitors are practically governed by private large conglomerates, which have their own manufacturing systems. They are substantially linked to their equipment manufacturer unlike Korea Telecom. I believe that the existing procurement system should be abolished in order to provide the internal R&D capability for KT; and KT should have a manufacturing function. (Yim, Hong-Soon, 22 February 1995a)

The linkage between service provision and manufacturing directly affects the existing R&D system and procurement process. The status of Korea Telecom is challenged by competition in many respects including the linkage between service provision and manufacturing. The next section shows the changing status of Korea Telecom in the changing environment.

9.2.4 The Changing Status of Korea Telecom

Korea Telecom has attempted to satisfy expanding telecommunications demand through the rapid development of the Korean economy in the 1970s and 1980s. Korea Telecom has had a monopolistic status and been state controlled as a public firm since the early 1980s. It is still a dominant network operator, as well as service provider, despite the fact that competition has been introduced since 1991.[42]

Competition is being expanded beyond services to include networks. Korea Telecom is quite fearful of the network competition. An interview with a member of staff in Korea Telecom shows the concerns;

> The competition in service areas is not a very serious matter compared with that in networks. Other public companies, such as Korea Electricity, the Korea Road-Developing Agency and the Korea Railway Agency, are now eager to invest in networking, and they expect to be allowed to provide telecommunications services. Although they have spare facilities in their internal networks, they have been prevented from providing telecommunications services. The thing is that, because they have not been allowed to provide public telecommunications services, they have been free from regulation,[43] so that they have not been restricted to buying and installing foreign equipment. They could have a higher quality of network. It is not economical to invest in multiple networks in such a small country; and, further, it is quite dangerous to open up competition in networks in that this policy could invite foreign companies to invade our national telecommunications network. (Shin, Byung-Chon, 22 February 1995b)

---

[42] Korea Telecom identifies itself in public statements, first as a 'Service Provider' which responds to user demand on the basis of that "KT will develop and distribute new services which suit our culture and customs with the concept *easier, wider,* and *available in any condition*"; second, as a 'Network Provider' which "evolves existing networks and constructs advanced networks as the infrastructure of the information society, as well as facilitating, managing and leasing the public network facilities through developing networks to be realised in complex functions including data, image as well as voice"; and third, 'Technology Leader' which "leads high performing technology in telecommunications and establishes an independent technological capability" (Korea Telecom, 1994).

[43] KT has been regulated by two laws: 'The basic Law for Government Investment Organisation' which concerns the economic activities of public firms; and, 'The basic law for Telecommunications' and 'Telecommunications business law', which concern the structure of telecommunications business regulations.

It is true that competition in networks is rarely allowed in the other countries, whereas competition in services has been introduced in many other countries.[44]

As a traditionally recognised network operator, Korea Telecom wants to keep the privilege. An interview with a member of staff in KT shows its argument and reveals a similar perspective to the interview quoted above; but this interview presents a more radical view. In fact, he used to work for Korea Telecom Trade Union, having played a vital role in developing a policy proposal.

> The direction of network evolution, I believe, is the process of reinforcing our dependency on the US system. In terms of regulation, we are just following US deregulation. The problem is that the deregulation policy is only concerned with newly-emerging common carriers rather than with KT. Korea needs a strong representative common carrier which will be able to compete with foreign companies especially the USA, preparing for the open market. KT is in charge of PSTN and KT should be identified as the nation's firm. Regulation tends to be focused on KT, while the Government deregulates the business of the new common carriers, such as DACOM and KMT. (Yim, Hong-Soon, 22 February 1995a)

This opinion argues that Korea Telecom should be privileged in a competitive market place to pursue national competitiveness. On the other hand, it overlooks the 'fair competition' principle. In the telecommunications area, because of the presence of the monopolistic common carrier like Korea Telecom, the introduction of competition comes with 'asymmetric regulation', meaning that the existing common carrier should allow competitors to use its network facilities to a certain extent. Often, the new competitors are able to offer services with lower tariff schemes than the existing carrier's scheme until the competitors' market share is considerably expanded. The access charge for using the existing common carrier's facilities, the extent of use of facilities, and the tariff scheme for new and existing competitors are largely institutionalised as regulatory instruments, determined by the intention of regulators as to what extent competition should exist, or by negotiation between the carriers.

---

[44]Competition in the network operating area is certainly important compared with competition in the provision of services. The service provider does not have to own a network as it leases a certain capacity from the network operator. Whereas service providers use facilities of network operators, network operators own and construct the network. Korea Telecom has two functions at the same time, and the network is now open to many service providers in competition with Korea Telecom in the service provision area. The network area had been Korea Telecom's exclusive realm until the recent introduction of competition was deployed in 1996.

The new carriers complain about Korea Telecom's attitude towards competition. A member of staff in DACOM shows the frustration:

> Korea Telecom is not co-operative enough for fair competition. It even refuses to provide local loop facilities. In principle, of course, it should. Sometimes, traffic does not work with uncertain problems. You know what is happening in the interconnection? For example, the access charge for interconnection is based on costs. O.K. That's fine. When we actually calculate the costs, it becomes very complicated to work out because there is no clear standard to mark the boundary between local and other facilities including long distance. KT is always complaining that its losses in operating the local loop is too much. In fact, the local loop tariff has been increased by more than 70% since 1990. The problem is that we do not have a transparent framework for accounting for the loss. KT insists it will not show how it accounts for its costs. (Jung, Tae-Chul, 24 June 1996)

In terms of national competitiveness, I raised the question as to whether this interviewee could consider Korea Telecom's privilege. He argues that because of preparing for the open market and of improving national competitiveness, KT's attitude should change:

> Well, there is certainly something we also understand from KT. KT has been regulated more than other countries' PTO because of its status as a public company. KT certainly has limits on its autonomy. There is only a limited space where KT has flexibility in its management. I agree with the point that KT should be released from public company regulations, as KT is no longer the only company which provides services. But if KT still sticks to its privileged status, free from competition, I think it's absolutely anachronistic way of thinking. If KT continues to insist on its current position, our telecom industry, as well as KT itself, will be damaged. Now, if there is any problem between KT and DACOM, we can go to MIC together for resolution. But, you see, once foreign companies have entered our market, do you think they will go to MIC? No way, they will go to an international court. We should prepare for that stage. I suspect this kind of issue crops up all over the world. The difference is that we do not have a proper institutional environment. You know, KT sees DACOM as a bug. (Jung, Tae-Chul, 24 June 1996)

If the policy favours monopoly, even to a certain extent, the space where competitors can expand their business is relatively limited. Conversely, if the policy supports competition, the environment where the existing carrier provides the service becomes harsh. Which policy is favoured is determined by economic conditions, political intentions, and the standard of value in regulation. There is no such proper measurement. The regulator, however, could choose a way which provides a privileged environment for Korea Telecom, if it judges that the national competitiveness can be achieved by fostering one strong common carrier rather than promoting fair competition. The dominating discourse of 'national competitiveness', however, entails 'competition'. Regulation certainly depends on what political intentions accompany the search for national competitiveness.

Although introducing competition has been undertaken and the status of Korea Telecom has been challenged, there are policy considerations to support Korea Telecom's competitiveness in the newly announced policy document of 1995. The continuing interview explains the situation:

> The facilities and network KT operates have been constructed through long-term support from institutions and people's taxes. They seem to think the network is their own property. In fact, the policy has favoured DACOM, because the Government postulates competition anyway. Now actually, the direction of policy is being changed to favour Korea Telecom because the Government sees more possibilities for Korea Telecom to compete, for example, against the terrifying AT&T. Whether or not the Government likes it, it does not see the feasibility of DACOM being able to offer strong competitiveness. In 'the basic policy direction of the telecom industry', we can see the commitment of government in declaring that it will foster KT as the dominant carrier in Korea. Under this principle, KT enters into new service areas when the Government selects the service providers.[45] On the other hand, the policy has the direction to issue new licences to private sector firms which have not entered the telecom service industry. That's why DACOM is now in trouble, and this is the challenge we face. (Jung, Tae-Chul, 24 June 1996)

The issue of competition comes with that of the privatisation of Korea Telecom. Despite the introduction of full competition, privatisation has not been taken the whole way; the Government has only sold 20% of its share in KT so far. The privatisation of Korea Telecom was confirmed in July 1987 as an incremental step towards the privatisation policy of the public firm announced in March 1987. The schedule of selling government stocks has been delayed because of stagnation in the domestic stock market. Table 9-3 shows procedures for privatising Korea Telecom reflecting the telecommunications market restructuring and political situation.

The issue of how much government stock will eventually be sold to the private sector - over 51% or up to 49%[46]; who will be the dominant stock-holder[47]; and how the relationship between privatisation and regulation will be resolved, have not yet been sorted out.[48] It

---

[45] Korea Telecom is granted a licence for PCS, which allows it to enter wireless service provision in 1996 (see Table 9-2).

[46]The issue how much stock the government sells is quite critical (i.e. over 51% or 49%) because these percentages mask a turning point as to whether KT remains a public company which is ruled by the law "The Basic law for government investment organisation" or is privatised completely.

[47]The issue of who will be the dominant stock-holder is related to the *chaebol*'s interests. It is a very critical issue of public interest because ownership can remain public with assessing limitation of holding stocks to one stock-holder.

[48]One evaluation of Korea Telecom was carried out to support privatisation, funded by government, pointing out the weak management points of Korea Telecom in terms of inefficiency caused by public ownership (The Consortium, December 1994). The report suggests that the Government should sell over 50% of its stock.

remains quite vague as to whether Korea Telecom will be completely privatised through the selling off of more than 50% of government stock if the situation remains where MIC still enjoys advantages in controlling Korea Telecom.

Table 9-3 : Procedures for Privatising Korea Telecom

	'93	'94	'95	'96	'97
Ratio of stocks sold	10%	10%	14%	15%	?
Political Situation			Local government election	General election	President election
Telecommunications sector	Opening procurement market	Restructuring of the regulatory scheme	Introducing competition on long distance	Issuing 27 new licences	Opening Basic service

Korea Telecom is faced with criticism that it has not been performing very well in terms of the efficiency of its organisation in the changing environment,[49] and this is the basis of calls for its privatisation. Privatisation is discussed alongside the issues of the divestiture of Korea Telecom in such ways as regionally, functionally (e.g. maintenance, the 114 number service and the other profitable services), its service types (e.g. long distance, international, etc.) and its services and infrastructure.

I had an opportunity to find out what the staff of Korea Telecom feel, being faced with the privatisation issue, by interviewing a responsible member of staff in Korea Telecom, who deals with business strategy and regulatory issues. He suggests that Korea Telecom needs to be privatised to improve efficiency of management.

[49]According to a management evaluation of Korea Telecom, whereas the added value increased by 1.51% in 1993 compared with the previous year, personnel expenditure increased by 10.3% and managing expenditure increased by 11.32%. In addition, a very high portion of employees of Korea Telecom intend to leave their jobs - 72% -, which reflects that a high proportion of employees are not satisfied with the organisation: only 36% of employees are proud of their organisation, and 24% are willing to accept the value and mission of KT (The Consortium, December 1994: III-7). The report also pointed out that although Korea Telecom is ranked eighth in the world with respect to the scale of circuit, it is ranked twenty-third in the world with respect to the scale of growth. The labour productivity per person of KT is 62% of AT&T and 52% of NTT. NTT reduces its numbers of employees at the rate of 4% a year and AT&T does at the rate of 3%, but KT rather increases its labour power at the rate of over 3%, 2,000 in number (The Consortium, December 1994: I-2).

> In terms of inefficiency, KT needs change, which, I believe, privatisation will bring about. Privatisation would provide people in KT with more incentives and a competitive environment. The twenty three public companies[50] are strongly regulated by EPB (the Economic Planning Board) in terms of budget, manpower, investment, managing board and institutional affairs. The government needs to regulate public companies in some way, I know; but, in the telecommunications field, KT now confronts the rigid environment of competition with KMT and DACOM, which are now substantially owned by large conglomerates, such as *Sunkyung* and LG respectively. Nevertheless MIC, which has announced the privatisation of KT, is not likely to be eager to have KT privatised in practice. As long as the Government's portion of stock in KT is over 50%, KT is supposed to be regulated by the law[51], which still leaves space in which government can exert its power to intervene in the management of Korea Telecom. (Shin, Byung-Chon, 22 February 1995b)

Korea Telecom does want to be privatised, but, at the same time, it wants to retain the privileged status made possible by belonging to the public domain. Competition in telecommunications is likely to become fierce as the policy standard seems to lie in reinforcing national competitiveness through promoting competition in the private sector.

The changing status of Korea Telecom has brought about dilemmas in policy concerns, between fostering a representative carrier for national competitiveness and promoting a competitive environment also for national competitiveness. The issue faces strong anti-government criticism with respect to public interests, in the trade union movement. The next section deals with this issue and how it is being resolved in the context of the Korean society.

9.2.5 Exclusion of the Opposition Group

Korea Telecom Trade Union (KTTU) has a short history after being democratised (1994), putting an end to the long history of its notorious predecessor which was in collusion with government and the management of Korea Telecom. KTTU is the largest union in Korea[52] with 50,000 members and the most powerful union within public ownership firms. The

---

[50] There are 23 public companies in Korea in the areas related to the construction of infrastructures, public expenditures, and state monopolistic profit. Those companies are regulated by special Laws.

[51] The Basic Law for the Government Investment Organisation

[52] Korea has an extraordinary trade union system of intra-firm unions. Unlike the general system organised by a common industrial base, trade unions in Korea are organised by firm units, which are recognised in law. In fact, it is likely to be a good environment for establishing friendly relationships between firms and unions, on the one hand; but on the other, it is a really hard environment to establish democratic and independent unions. The democratic trade union movement was set up in Korea, though; and the democratisation of KTTU is one result of a long and historical labour movement, which is a critical event for the labour movement in Korea in the sense that KTTU has the largest membership and the importance of its industrial characteristics.

democratised KTTU has been against the policy deployed by government, especially with regard to the introduction of competition and the privatisation of Korea Telecom.[53]

I interviewed a member of the executive committee in KTTU, who is responsible for presenting and developing the policy proposal. The policy, however, is not only a matter of the public interest, but, also refers to how KTTU will survive in a privatised environment, and, further, in the harsh environment of the democratic labour movement in Korea. The interviewee argues about the significance of KT in the telecommunications industry in Korea:

> We have got to understand the characteristics of KT as a firm, the circumstances leading to the opening up of the telecommunications market, and the nature of the telecommunications industry, and to propose the appropriate comments concerning the public interest. We support Korea Telecom's privileged status to be the 'National Flagship Carrier' to protect the 'Nation's telecommunications' because we believe that we need a stable and healthy national firm which can compete with foreign companies. (Kim, Hyung-Man, 14 February 1995)

KTTU believes Korea Telecom should play a major role in competing with foreign companies and providing public services properly. KTTU supports the position of Korea Telecom arguing that Korea Telecom should be protected from competition. KTTU as a whole however, argues against privatisation unlike the interview with a member of staff in Korea Telecom who accepts the necessity of privatisation introduced in previous section. The interview continues as follows:

> ... The government has been selling and planning to sell 10% of its stocks in 1993, another 10% in 1994, 14% in 1995, 15% in 1996, which is ultimately summed up to 49% of the government's portion; and, we are now faced with an entire opening up of the basic service ... If we look at the process of selling government's stocks, the government is only eager to earn money from stocks which should be people's stocks ... We are, however, now in a dilemma: we are definitely against the privatisation of KT, which is the people's property and, which has been fostered by the monopolistic provision of services in the name of the public interest; but, we do not trust the government, either. We witnessed how the government did not pursue the public interest in operating public firms ... The public ownership of

[53]The perspectives on privatisation of KTTU are found in a internal document as follows:
First, KTTU criticises the fact that the logic of privatisation of public firms often resorts to 'inefficiency' argument. "Who should be responsible for that inefficiency? Inefficiency results not from public ownership, but from the management without autonomous power, which is caused by extreme government intervention; and the simple logic, 'efficiency equals competition' cannot be the logic of privatisation."
Second, KTTU claims that the process of privatisation should be open to employees in public companies. "It's a fabrication to have a process of privatisation without listening to employees' interests and public opinion."
Third, KTTU argues that the characteristics of Korea Telecom, an important part of public domain, should be recognised; and it declares that "KTTU is a policy union to protect 'National Telecommunications' and guides the management of Korea Telecom" (KTTU, Materials of education for Union members, 1994).

> Korea Telecom has also allowed political powers to abuse Korea Telecom for its own political interests. In that sense, the public feature of KT still entails the danger. (Kim, Hyung-Man, 14 February 1995)

KTTU is concerned about the problem of public ownership in Korean society. In fact, public ownership has been abused in the middle of the long history of military dictatorship, being used as a financial resource to sustain immoral political power, and as places where political powers can provide their own people with jobs. It is true that there are still many top management people who used to co-operate with the dictatorship or whose original job was in the military.

The issue of privatisation is also a matter of survival for KTTU, because it will possibly cause instability of employment and organisational change. The interview continues:

> We predict that privatisation will heavily distract our organisation, you know ... We have only a one-year history since democratisation. We have not got around to establishing our concrete internal organising power in the union ... The way towards privatisation is now discussed with the points of divestiture of Korea Telecom. The likelihood is that the maintenance function and 114 number guide service will be separated from the service and network function. If those functions are separated from the main body of Korea Telecom, KTTU will lose the main body of its members. (Kim, Hyung-Man, 14 February 1995)

KTTU seemed desperate to seek a way to survive. I left Seoul in early 1995, having seen KTTU planning public advertisements and preparing collective negotiation for the following spring.

It was in June 1995, when the political regime declared its intentions for the telecommunications industry and its labour force by repressing KTTU. Even with the warning strike in the process of 'wage negotiation', the representative and executives of KTTU were arrested, in the middle of resorting to a stay-in strike in a Catholic church and Buddhist temple. It raised moral issues about the political powers which were supposed to be democratic under the civilian President.

The position of KTTU on the privatisation of Korea Telecom and on the open market policy was publicised in advertisements during its desperate struggle with the Government. KTTU criticises the humiliating concessions made in the process of negotiating the opening up the market with the USA:

> The Government has accepted the request of the USA that the USA will participate in procurement without any type approval procedure of its switching system up to 50 hundred million Won per unit on March 1995, after having promised to open the basic telecommunications market from 1997 under pressure from the USA ... We do not mean that we are always against an open market policy. We propose that the Government should be considerate, by hearing public opinion and should be autonomous from the USA. (31 May 1995, Dong-A Daily)

The advertisement continues as follows to criticise the state's privatisation policy:

> The Government argues that privatisation is the only way to remove the inefficient management of public companies. It has not been proved that private companies are always more efficient than public companies. Telecommunications should not be privatised without deep consideration because of the importance of the public interest. In addition, Korea Telecom is quite a healthy company which has six million million Won for growth and six thousand hundred million Won in profit. The inefficiency of public companies results not from public ownership but from favouritism of top management by government and by regulation. State-owned companies like Korea Telecom are not autonomous because of unreasonable government intervention in appointing the president of company and in directing investments. If *'chaebol'* and foreign capital hold telecommunications, *we cannot expect them to invest in pay phone, 114 number service, telegraph, network construction for remote region, which Korea Telecom have willingly submitted to invest in...* There is the enormous possibility that Korea Telecom will be privatised in a way which provides benefits for *chaebol.* The government has already sold 20% of its stocks by competitive bids, which allow *chaebol* and a small number of people to take over the stock ... We are against a facile privatisation which provides *chaebol* with public fortunes in a privileged way. We propose that telecommunications which has a strong public function remain in the public domain and that Korea Telecom introduce expert management systems, internal reformation and autonomous management. (31 May 1995, Dong-A Daily, Seoul, Korea; emphasis added)

The event is very critical, for it shows how the authoritarian mechanism works, by excluding the opposition group (see sections 1.2.4, 1.2.5 and 3.2). It looks as if the event only involves the labour movement. KTTU, however, is the only organisation which raises public concerns about telecommunications policy related to privatisation and competition in Korean society. This way of treating the labour movement is also intimately related to the issue of authoritarianism (see sections 1.2.5 and 7.2). The event appears to be related to wage negotiations. However, in fact, the outrageous reaction of government seems a political tactic to drive a wedge through the single group opposing privatisation of Korea Telecom, through appealing to public opinion raised by people's uneasiness about strikes in the public sector, and through keeping the existing basis of oppressing the labour movement which people in Korea are still familiar with.

9.3 Technology Development In The Changing Telecommunications Industry

This section particularly looks at challenges to national R&D system in the telecommunications sector from open procurement market (9.3.1) and liberalisation (9.3.2) based on the examination of restructuring of telecommunications in precious sections.

9.3.1 Challenges From the Open Procurement Market

Korea Telecom contributes to fostering domestic manufacturers in the telecommunications industry by making maximum use of its procurement power, which covers over 90% of the telecommunications apparatus market in Korea. KT has implemented such measures as a demand forecasting system and a quality assurance system (see section 8.4).

A member of staff in Korea Telecom, who is working for the technology development strategy, describes the contribution of Korea Telecom to achieving a national technology capability:

> MIC recommends all telecommunications service providers should invest in R&D at the rate 6% of turnover.[54] The existing procurement system has made private manufacturers participate in co-operative R&D. Up to now, KT has fostered national technology development through supporting technology development in ETRI, transmitting technology to private companies and procuring equipment, while other potential competitive providers have purchased foreign equipment. I believe a national technology capability has been achieved, which can be judged to be only 3-5 years behind that of advanced countries. (Cha, Jae-Young, 28 February 1995)

So far, KT purchases foreign equipment only if the domestic supply is not sufficient to meet KT's demand. Korea opened its general telecommunications goods market to foreign companies in 1992; and it opened its network equipment market in early 1993. The open procurement market marks the end of a stable market for domestic manufacturers; and, on the other side of coin, the WTO system impinges on existing technology developments in the Korean telecommunications industry.

The R&D - procurement chain in Korea becomes 'unfair' under the WTO system because the chain exists to foster domestic manufacturers rather than to ensure the best available system for PTO. The open procurement market means full competition between foreign and domestic manufacturers. The strong government initiative in technology development becomes 'unfair', as it favours domestic manufacturers by supporting their technology

---

54 In the Telecommunications Law.

developments. The interview below shows Korea's dilemma in the changing environment. A member of staff in ETRI, who used to be responsible for the R&D planning department and now works for the technology development plan for the KII programme, says:

> Under the WTO, the government research should be focused on areas where the market fails to penetrate, i.e. basic research. In other countries, private industry leads technology developments, while government plays a role in creating motivation. Looking at our existing technology development, we now suddenly get lost in the principle of 'basic research', which covers only 1-3% of all research projects. What does basic research mean for us? You see, we did not have a choice as we did not have enough resources. If we had followed the US system, within which the government plays a role in basic research, we would not have succeeded in developing TDX or CDMA. It was right to develop something urgent with limited resources strategically. The change into the WTO system means a greater burden on the private sector, in fact. In the case of CDMA, the Government leads the commercialisation process. Now the Government does not do it any more. (Kim, Seong-Youn, 12 June 1996)

The interview suggests that the role of public institutions is being redefined under the WTO system. ETRI, the distinctive public institute for technology development in telecommunications, faces a challenge to its role in the new environment (see section 8.3). The role of ETRI is required to change from leading strategic technology development into supporting basic research. This change concurrently brings the phenomenon that the stable environment for domestic manufacturers is changing towards a more competitive basis. The interview continues:

> In the existing framework, after a public institute made a prototype, private manufacturers take charge of commercialising it. In some ways, this privileged the big companies. They were guaranteed procurement. But now, at the commercialising stage, the real competition between manufacturers begins depending on design, management capability, and solutions for technology. (Kim, Seong-Youn, 12 June 1996)

The above opinion suggests that domestic manufacturers are being faced with a more competitive environment, free from government support. The open procurement market has certainly challenged the existing R&D system. However, on the other hand, the mature private sector has accumulated its own capability in a stable market. Another interviewee in ETRI sees it as essential to establish a new R&D scheme, which encompasses the capable private sector.

> It is time to change the national technology development policy from government initiatives into competition within the private sector, as the WTO system does not allow in its existing technology development system. In fact, the technology

> capability of the private sector has been strengthened; and R&D costs have increased enough. The private sector is rather powerful. (Kim, Sung-Kyu, 7 February 1995b)

Whilst the open procurement market forces the co-operation between government and the private sector to be broken, the mature private sector now seeks competition in freedom rather than in support by regulation. The private sector is also concerned about its changing status in the process of introducing competition. As we have seen in section 9.2.3, manufacturers are entering service provision, which is not likely to mesh well with compulsory procurement by Korea Telecom. The next section shows how the introduction of competition affects existing technology development system.

9.3.2 Challenges from Competition

The existing technology development system was linked with the stable status of Korea Telecom as both a customer and a funding body. Introducing competition has complicated the clear distinction between customers and manufacturers. A member of staff in Korea Telecom describes how competition intimidates Korea Telecom with respect to the existing R&D scheme:

> KT has funded state-of-the-art technology developments in the telecommunications equipment area - for example, KT funded development of 2.5 Gbit transmission equipment although it is already available in foreign markets - whereas Korea Electricity, which was involved in providing only internal telecommunications services, has purchased foreign equipment freely. Now, Korea Electricity is eager to participate in service provision, by utilising that advanced equipment. Other competitors are about to purchase AT&T's switching system, 5ESS2000, which KT is prevented from buying. (Yim, Hong-Soon, 22 February 1995a)

The competitive environment makes it problematic to impose compulsory procurement and funding for technology development on Korea Telecom. Korea Telecom is now preparing to compete with companies which used to be too immature to be independent from Korea Telecom; but which are now powerful enough to tackle Korea Telecom.

> In terms of R&D co-operation, we cannot say that KT's support is now a main factor in the R&D capabilities of the private sector. The private sector is now capable enough to develop technology on its own. For example, *Samsung Semiconductor co.* which sold TDX with 300 billion Won to KT when it was *Samsung electronics co.*, is now supported by the *Samsung* R&D institute, and it has up to 2,000 members of staff. *Samsung* could develop technology by itself; but if the technology does not realise profit, *Samsung* would not develop a technology without guaranteed procurement. (Cha, Jae-Young, 28 February 1995)

The existing procurement system which is linked with government-controlled R&D activities and which has in the past provided a stable market for manufacturers does not suit the present technology development stage of the telecommunications sector and its current competitive status.

The argument voiced below implies the danger of privatising Korea Telecom, which is then likely to pursue profits itself rather than endeavour to improve technology capability, which is now happening in large private manufacturing companies.

> After privatisation, we cannot promise to procure equipment from domestic manufacturers. In order to foster our own capability, we have expanded our internal R&D facilities, which have continuously had conflicts with MIC which supports ETRI. KT is now planning to be a complex telecommunications provider which includes manufacturing, for competitors are now strongly connected with manufacturers. For instance, LG is the main stock-holder of DACOM; *Samsung* has a strong power base in Korea Electricity which is now seeking to participate in network business. (Cha, Jae-Young, 28 February 1995)

Korea Telecom has had to fund the R&D activities of the external public organisation, ETRI, rather than concentrate on developing its internal capability. Under conditions where the role of ETRI remains in conducting basic research, there is the on-going suggestion that the major function of R&D in ETRI should be transferred to KT. KT is now trying to reinforce its internal R&D capability.[55] According to the mid-long term technological development strategy of Korea Telecom[56], announced in June 1992, KT is ready to provide

[55] With respect to the manpower of the whole telecommunications sector, R&D manpower is only 8% of AT&T's. The scale of investment is not even up to 8% of AT&T's. Although KT has increased investment in R&D at the rate of 30-120% every year since 1991, the quality of R&D is still low. Whereas the number of R&D activities are increasing, the ratio of utilising research results to develop commercial products is rather decreasing. In the case of 1993's performance, only twenty projects have been commercialised and utilised out of seventy two projects completed by R&D. In the case of patents, although the numbers of domestic patents are gradually increasing and international patents too, only three to sixteen units of international patents were successful, which still shows a very poor performance, considering the scale of business of KT and the status of KT in the Korean telecommunications industry.

[56] Korea Telecom announced its technology development strategy under the title of "TOP" (Telecommunication Oriented Paradise). The strategy is divided into four areas as follows:
1. TOP- Service: orienting individualisation, visualisation, multi-function (operator initiative, quantity orientation -> user initiative, small quantity and versatile type of service orientation)
1993: provision of intelligent services of basic voice service, non-voice, integrated service
1996: provision of ISDN, IN (intelligent network) service
1997: improvement of IN, PCS (personal communication services)
2000s: provision of broad band ISDN service
2. TOP- Network (PSDN -> digitalisation)
1996: Through construction of the SDH basic transmission network, No.7 signal network and intelligent network, pursuing ISDN
1997: construction of nation wide ISDN
3. TOP- Technology
- selection of top ten substantial technologies
- aiming at achieving the level of technology of the seven most advanced countries in 2000s

intelligent network services toward broad-band ISDN services and to construct nation-wide digitalised ISDN networks, through huge amounts of R&D investment, i.e. 330 billion Won until 2001.

The concern about the internal R&D capability of KT is interwoven with privatisation of KT. A privatised KT is likely to pursue market principle rather than national interests. To some extent, KT should respond to efficient market principles, however, KT is still expected to play a vital role in developing technology through national procurement. In fact, in the face of the open procurement market, KT has been searching for a tactical method to protect the national market. On the one hand, KT is expected to protect the national procurement market through institutional tactics; on the other, it needs to reinforce its internal R&D capability because funding and the technology transfer process, etc. are not exempt from the open procurement market principle.

The privatisation of Korea Telecom will influence the national R&D system in the telecommunications sector. Given that private manufacturing companies in Korea are now capable enough to perform R&D activities by themselves, and considering the technology capability of the Korean telecommunications industry, there will be a need to sustain the stable development of technology. The competitive service market and network competition are apt to link with manufacturing functions, as we looked at it above, so that the linkage between procurement and R&D activities is likely to be fragmented into several units.

9.4 The Issue of Universal Service

The issue of universal service is being highlighted in the process of opening up the market internally and externally. The concern is that the vague principle and method of realising universal service becomes a hurdle for liberalising the telecommunications market place, as it is used for protecting the existing PTO to sustain its monopolistic power. A member of staff in DACOM describes the business concerns:

---

4. TOP- Environment (R&D investment)
1992 - 2001 : R&D investment 330 billion Won (1£= 1250 Won)

> Well, there is no agreed concept, as to what is universal service in our country. It's too vague. Maybe "the whole telephone service should be available for all the people." From that point, KT always says that the competitive providers should compensate for the immense loss in the local loop for sustaining universal service. Competitors like us say, "No, KT, the local loop does not yield that much loss, even that there is no loss because you have already got enough tariff from customers in the local loop." How much are real costs, then? Well, we are arguing everyday. That is a really hot issue between KT and its competitors. (Jung, Tae-Chul, 24 June 1996)

The notion of universal service is still perceived as something that competition should not damage. The interviewee strongly refuted that competitors could ignore the notion.

> No, it is impossible to deny the necessity for universal service. If we do that, we would be regarded as an immoral and selfish carrier. The problem is that KT includes too many things such as data communication, super-highway network, 114 directory service, administrative telecom service, etc., etc. in the area of universal service, with which they ask the competitors to compensate for loss. Well, in the area of data communication, it is DACOM that has had losses since the service was launched. We are trying to limit the scope of universal service within the telephone service. Even within the telephone service, we are arguing that KT does not sustain that much loss because they charge subscription fees, which are not practically refundable (institutionally, they are refundable when the subscriber quits the service, but practically nobody gets out of the network once they subscribe to the telephone. So, subscription fees are accounted as 'debt' in KT's calculation, which we do not agree with.) They earn enough profit from the rapidly increasing tariff on the local loop. (Jung, Tae-Chul, 24 June 1996)

A responsible member of staff in KMT also strongly argues that the vague concept of universal service is abused by Korea Telecom in justifying its increased access charges. He responded to the question that Korea Telecom could be privileged for sustaining universal service as follows:

> Absolutely I cannot agree with the point. The implementation of universal service is, eventually, a matter of subsidising it. The concept of universal service in the past was towards preventing competition. The task now is that the concept of universal service can be made compatible with a competitive environment. (Lee, Ju-Hyung, 17 June 1996)

He suggests that a way to be considered is:

> I am prepared to compensate some amount of subsidising, not to Korea Telecom, but to a certain objective body for establishing a proper subsidy for universal service. For example, we could introduce a universal service fund. (Lee, Ju-Hyung, 17 June 1996)

The interviewee in DACOM is rather sceptical about a universal service fund:

> I don't think the universal service fund in the US system fits our circumstances. The USA has a NTS[57] loss share, as well as a universal fund for different costs of local

[57] Non-Traffic Sensitive: a local access network

> discrepancy. Basically, the NTS loss share is right. The problem is that it is difficult to make clear what real loss is. I basically agree with the point that competitors should compensate for the loss, which was inevitable. Say, there is, 3000 million Won loss. In that, there are also losses from inefficient management. It's really unfair to compensate those losses which result from the competitor's management mistakes. We want transparency in accounting for the loss. We only see the last page of the accounting book. (Jung, Tae-Chul, 24 June 1996)

The distinctive concern about universal service between competitors and the existing PTO lies largely in the issue of establishing a valid standard for compensation.

9. 5 Summary

A series of telecommunications policies towards restructuring the telecommunications market are being deployed, responding to pressure to open up the market and to change economic policy in favour of liberalisation in Korea. Competition in a number of areas in telecommunications is being introduced. In the process of introducing competition, the interests of *chaebol* are involved by their participation in highly profitable areas such as mobile communications. The existing division between services and manufacturing is collapsing as *chaebol* enter into the business of network and service provision. Korea Telecom, the existing PTO in Korea, is faced with challenges from the liberalised market and from the issue of privatisation. Korea Telecom Trade Union (KTTU) postulates anti-competition and anti-privatisation of Korea Telecom, referring to the protection of the national flagship in the telecommunications sector.

The restructuring of the telecommunications market affects the existing R&D system. This system used to cohere in a stable chain: funding for R&D by the network operator - R&D co-operation between public institution and manufacturers - production by domestic manufacturers - guaranteed procurement by the network operator. This system existed with government initiatives, supported by Korea Telecom and the ideology of indigenous technology. This existing R&D system is now challenged by the open procurement market and by the introduction of competition.

The issue of universal service is observed in the dispute over KT's privileged status in the process of introducing competition. Universal service is still taken for granted in policy concerns, but the question of how universal service can be sustained in a competitive environment is now under review. Competitors argue that universal service is abused by Korea Telecom to protect its privilege, suggesting that the concept of universal service should be redefined to suit a competitive environment.

The next two chapters 10 and 11 examine the cases of Korea Information Infrastructure (KII) and CDMA in the light of the restructuring of the telecommunications market examined in this chapter.

The KII programme is being launched in the middle of the restructuring of the telecommunications industry, backed by the strong vision and commitment of the Government. The case study shows how the KII programme reflects the upheaval in the telecommunications industry such as the changing status of Korea Telecom, and the changing nature of the sector from a public service to a highly profitable industry. The case of CDMA development was undertaken in the existing R&D scheme. In practice, it is observed that the challenges brought by the open procurement market, by introducing competition and by initiatives of mature domestic manufacturers emerged in the process of CDMA development. The case of CDMA shows the shifting balance of power between players, particularly, between the Government and private capital.

Chapter 10: The Case of Korea Information Infrastructure

10.1 Introduction

Telecommunications consists of a network conveying voice, data and image. It is the network where the dominating discourse in society and the interests of social forces are forming and crossing institutions and technologies, simultaneously. Telecommunications is in the mist of a rapidly changing environment nowadays. While the case of Korea is not exceptional, telecommunications in transition in Korea reflects its particular social context. To reveal with a closer focus how institutions are changing and how social forces are shaping this area, I look at the case of Korea Information Infrastructure (KII), the national initiative for network evolution, launched in late 1994.

As the KII programme is an on-going project and is still in its initial stages, how the programme is being undertaken is not very obvious beyond what has been planned and how the players' positions have been constructed. The aims and strategies may change over time. The programme, however, is selected as a microcosm to show the process of change in telecommunications, since it embraces how the national initiative of network evolution is being built, reflecting policies in regulation and industrial concerns, and the political and economic interests of players such as MIC, Korea Telecom and *chaebol*.

This chapter should be considered as 'understanding KII', rather than as 'how to achieve KII' or even 'propagating KII'. The chapter falls broadly into two sections. The first section deals with the nature of KII (10.2), by examining the concept in the context of the overall characteristics of telecommunications as an infrastructure; the features of network construction; and the concerns about technological development. The second section examines the process of KII's construction reflecting the political and economic interests of players and how they are shaping the network design (10.3).

10.2 National Initiative for Network Evolution

The KII programme is a national initiative for network evolution, a design effort towards constructing a reliable infrastructure for the future as well as improving existing network functions. This section identifies the nature of KII in the context of industrial policy and telecommunications network evolution, first, by examining the concept of KII (10.2.1); second, the contents of KII (10.2.2); third, the technology development plan for the KII programme (10.2.3); finally, constraints and practice of the KII (10.2.4).

10.2.1 Constructing SOC (Social Overhead Capital)/ Developing the Telecommunications Industry

It is largely assumed that the Korean Government started to pursue its own project in the process of reproducing the US idea of the Information Super-Highway, in which the National Information Infrastructure (NII) is suggested as having a crucial role to play in ensuring international competitiveness using a knowledge-oriented economic system. The Korean government acknowledges that multimedia information industry is a most positive one, saying that "it is possible for our country to be competitive in this field, considering that the USA and Japan are only in the beginning stages of their development" (MOC, March 1994).

If we look at the KII programme, we find a strong emphasis on investment in telecommunications as SOC (Social Overhead Capital) (see section 4.2). The concept of SOC is the initial discourse of KII as an aspect of telecommunications as infrastructure. In the Master Plan,[58] the term 'Korea Information Infrastructure' is defined as "the new social infrastructure which includes information equipment, software and social institutions - culture - customs as the peripheral environment, as well as a physical telecommunications network with which voice, text and image can be transmitted simultaneously and quickly anytime, anywhere" (KII Task Force, 1994). The telecommunications network is described

[58]The Master Plan of November 1994 was the final version of the series of plans for the programme. It was in August 1993 that the plan emerged officially for the first time, with the title of *A Basic Plan for the Construction of an Information Super Highway Network*. In January 1994, the plan was approved by the President's Commendation of Promotion, with which MOC (Ministry of Communications) has managed to establish the authority to deploy the programme. The plan, with more refined features, titled *The Master Plan for the Construction of an Information Super-Highway Network for the 21st century* was published on March 1994.

as a 'National Infrastructure' and a 'New- SOC', saying that "An Information Flowing Network reinforces industrial competitiveness and works as a resource of national property in the Information Age, whereas a Goods Flowing Network, such as road and port, contributes in economic growth in the Industrial Society" (MOC, March 1994). The concept of the programme has been refined in the final plan (KII Task Force, November 1994) by adding the 'infrastructure' concept to the simple 'network' concept envisaged at the beginning of planning.

The overall aims of the programme are as follows:

1. to be a country in the second group, following the USA and Japan, by constructing an Information Super-Highway network by 2015.

2. to realise universal informatics

3. to create employment and reinforce industrial competitiveness by fostering a multimedia information industry.

The programme became a blueprint for developing the telecommunications industry complex, as it brings together all the technology development plans in the telecommunications area, the existing network evolution plan, the B-ISDN project of Korea Telecom, and the industrial policy for fostering a multimedia industry (KII Task Force, November 1994).

The national initiative for network evolution concerns how much investment will be put in, and how this initiative meshes with telecommunications restructuring in general. The concept of SOC in KII represents the function of infrastructure[59] on the one hand, and the anticipation of boosting the industry in the area of multimedia[60] on the other. The private and public sectors with small-medium sized users and residential users could benefit,

[59]The high performing super-highway communication system is expected to enable people to send and receive information in various types (voice, text, image) anytime, anywhere for anyone, overcoming the limitation of time and distance, enhancing reliance of information transmission by digitalisation of the network; and it will provide interactive TV, video conferencing, remote education and remote medical services, as a direct effect of the network construction in the plan (KII Task Force, November 1994).

[60]In industrial aspects, it is expected that the infrastructure will create drastic demand and supply in the market for super-highway communications services: in the areas of manufacturing such as fibre optic cables, semiconductors, switching systems, multimedia equipment, computers and transmission equipment; in the areas of the software industry such as software for communications, software for applications and flow and software for database; in the areas of the network and broadcasting industry such as super-highway transmission, multimedia transmission and interactive digital broadcasting (KII Task Force, November 1994).

whereas the purpose of boosting the multimedia industry accommodates industrial policy. The dilemma between SOC and a liberalised telecommunications policy is the arena within which we can see how policy makers realign their strategies and plans in the process of deploying the programme.

10.2.2 Network Construction: National Information Network / Public Information Network

The programme covers four levels: '*Information transmission*' applied to transmission of super -highway communications, which consists of Satellite, PCS, Optical CATV and B-ISDN; '*Information flow*' applied to visual receiving and distributing functions which consist of multimedia equipment and Video Servers; '*Information application*' applied, for example, to remote education services, which consists of applications and databases; and '*Information society*' applied to social systems and educational systems which consists of customs, perspectives, education, manpower, and the legal and institutional systems.

Table 10-1: Whole Budget of KII

(Unit: hundred million Won, 1$= 750 Won)

section	first stage ('95 - '97)	second stage ('98- 2002)	third stage (2003 - 2015)	total
1. construction of ISH	8, 058	40, 391	380, 169	428, 618
. national network	2, 381	2, 402	3, 331	8, 114
. public network	5, 677	37, 989	376, 838	420, 504
2. test-bed network	140	178	292	610
3. public application service development	520	1, 480	1, 680	3, 680
4. technology development	5, 451	4, 280	6, 432	16, 163
5. pilot service	1, 555	1, 637		3, 192
6. public relations	48	55	77	180
total	15, 772	48, 021	388, 650	452, 443

(Source: KII Task Force, Master plan for KII, November 1994)

'Information transmission' which constitutes the physical network construction is the core of the programme in terms of budgeting (Table 10-1). The investment is aimed at constructing fibre optic cable in the access network (FTTH: fibre to the home), and this is expected to become economic in the next century in the world telecommunications market.

The overall feature of network construction makes a clear distinction between a 'national information network' and a 'public information network'. We should look at the practical meaning of the terms behind the language. This distinction is set up as a strategy[61] for network construction,

> Initially the national information network, which is expected to connect directly to reinforcing national competitiveness, will be constructed for public organisations, R&D institutes and universities, by government funding. This network contributes to creating an initial demand and use, as a base for applications and technology developments. The public information network for public use is constructed by common carriers on the basis of the demand and technology capability driven by the national information network. (KII Task Force, 1994)

The distinction between the 'national information network' and the 'public information network' is that the national information network will be set up first, expecting that it will create demand, which ultimately will contribute to establishing the 'public information network'. These two networks are divided in a logical way[62] rather than a physical one. In the beginning, the government intended to own the physical government network, but Korea Telecom was against the decision in terms of overlapped investment (Source: Cho, Yong-Kil, 12 January 1995).

The national information network will be constructed to promote common usage of information within public organisations, such as government, local administrative organisations and public institutions. It is expected to be utilised as an infrastructure for government administration networks, education and research networks, and test-bed networks for the 'public information network'. The network will make the most use of fibre optic facilities which common carriers establish and it will be constructed at the highest level to ensure the quality of the service.

It is intended that the national information network will be constructed within metropolitan area at first and then enlarged to cover small-and medium-sized cities through network connection points. The network will be structured to fit an open system which is exchanged

---

[61]This No.1 strategy is followed by

> 2. It will develop application services and main technologies in connection with industry, academia and public institutions.
> 3 Trial services will be deployed, and laws and institutions will be reformed to suit the changing environment.
> 4. The government will make efforts to promote the participation of the private sector.

[62] The logical separation means that the government will use some capacities in public networking with special applications for public use, rather than owning the physical network for the 'national information network'.

among networks and connected between different equipment to transmit multimedia information such as voice, data and image, and to be suitable for a distributed environment.[63]

The subscriber circuit will still rely on common carriers' construction of an access network in the form of a 'public information network'. The public organisations are expected to be a leading group who use multimedia in a high performance system.

The national information network does not exist on its own physical framework. The network is physically internalised in the network of Korea Telecom, which is encouraged to improve its network's performance by the KII programme with demand from public organisations and with funding by government. A member of staff in NCA, which is in charge of constructing the national information network, points out the role of the national information network as follows:

> The national information network is supposed to create the initial demand. The supply structure provided by the network is far ahead of actual demand. The Government takes the risk of promoting the construction of an advanced network by guaranteeing an initial demand from government organisations and the public sector, which gives a sort of incentive to Korea Telecom to construct the network. (Oh, Kwang-Suk, 19 June 1996a)

The strategy on how to construct the network reflects the environment within which the initiative is launched. The problem of the KII initiative resides in 'demand', and the government tries to resolve this problem in its network construction strategy. The

---

63 • The first stage (1995-1997): establishing basic facilities
- A transmission network will be constructed, considering information flows of middle-and small-sized cities: The transmission network will consist of 622 Mbps-2.5 Gbps performance which is 8 thousand- 3 million times more than telephone network over the five biggest cities (Seoul, Pusan, Daejon, Inchon, Kwangju); between the five big cities and key positioning cities, 155 Mbps-622 Mbps transmission network which is 2 thousand-8 thousand times more than the telephone network will be constructed.
- The exchange network will utilise data-leased circuits, which will evolve into a super-highway network
-A network which contains 45 Mbps to provide information services will be constructed in public organisations
- 1995: construction of 12 nodes, construction of exchange networks at 10 connection points, high performance transmission network of 8 thousand -3 million times more than the telephone network
- 1996: construction of exchange networks at 58 middle-and small-sized cities, construction of exchange networks which are 2 thousand- 8 thousand (155 Mbps- 622 Mbps) between nodes and connection points
- 1997: establishing ATM switching systems, construction of managing networks between nodes and connection points
• The second stage (1998 -2002) : Diffusion stage
• The third stage (2003 -2010): Completion stage

government tries to build up initial features first and to be the initial user for the services provided by the network.

If we look at KII's budget, the weight of the programme certainly resides in the 'public information network' (Table 10-1). To look closely at the features of investment in terms of the division of labour between the Government and the network operator, the government is found to concentrate only on initial stages of the programme in terms of the national information network and trial service (Table 10-2).

Table 10-2: KII's Investment by Government / Private Sector

(Unit: hundred million Won, 1$= 750 Won)

section	government	private	total
1. construction of network	8, 114 (1.9 %)	420, 504 (98.1 %)	428, 618 (100%)
2. test bed	610	-	610
3. public application service development	3, 680	-	3, 680
4. technology development	4, 732 (29.3%)	11, 431 (70. 7%)	16, 163 (100%)
5. pilot service	942 (29. 5%)	2, 250 (70. 5%)	3, 192 (100%)
6. creating environment	180		180
total	18, 258 (4. 0%)	434, 185 (96. 0%)	452, 443 (100%)

(Source: KII Task Force, November 1994)

The Government invests 4.0% of the whole budget. With respect to government investment, the Government-raised fund, 'Promoting Informatics Fund' also includes the existing fund for 'Information Communication Research and Development Promoting Fund' in 1996.[64] The funding for KII first will come from selling Korea Telecom's stocks (1,500 hundred million Won); second, from selling government's share of KT's stocks (3,500 hundred million Won); and third, from general government finance (8,526 hundred million Won).

When we look at the portion of government investment and private investment, we need to define the 'private sector' carefully. The data used in Table 10-2 are directly quoted from the 'Master plan'. The term 'private sector', as used by the Government, can be quite controversial, in that the 'private sector' used in the data indicates common carriers.

[64] The new fund was planned separately from the existing fund for promoting R&D within IT technology, 'Information Communication Research and Development Promoting Fund', which was expected to cover the area of technology development in KII (4, 732 hundred million Won). Now, it includes the existing fund, meaning that the KII programme covers all technology development programmes in the area of IT.

Common carriers in the plan apparently includes Korea Telecom, as Korea Telecom was the only entity which was involved in the access network. In the process of actual construction (launched in 1995), DACOM also became involved in construction, engaging in 30% of construction activities in the year plan.

The essence of KII lies in the 'public information network'. Korea Telecom is a main investor in this network. The subscriber loops, the most important part of KII, will rely on the 'public information network'. Korea Telecom has developed its own network evolution project with the construction of its B-ISDN (Table 10-3). The B-ISDN project of Korea Telecom became the contents of the 'public information network' in the KII programme.

Table 10-3: Korea Telecom's Plan for Construction of Fibre Optic Cable

	First stage (1992-1997)	Second stage (1998-2001)	Third stage (2002-2006)	Fourth stage (2007-2015)
Contents	Provision of FTTO*	Diffusion of FTTO	Settlement of FTTO	Evolution of FTTO
	Development of FTTC**	Provision of FTTC	Diffusion of FTTC	Settlement of FTTC
	Research on FTTH***	Development of FTTH	Provision of FTTH	Diffusion of FTTH
Aim	1%	10%	20%	100%

*Fibre To The Office, ** Fibre To The Curb, *** Fibre To The Home

The B-ISDN project includes; at the first stage (FTTO-Fibre To The Office: 1992-1997), providing fibre optic subscriber transmission equipment for FTTO to the buildings demanding high capacity, and constructing a pilot system; at the second stage (FTTC - Fibre To The Curb: 1998 -2001), constructing a Fibre City by selecting one region where large office buildings are placed, newly developed cities, and general subscribers; at the third (2002-2006) and fourth stages (2007 -2015), establishing nation-wide broad-band ISDN with a general subscriber fibre optic network.

The KII programme is seen as a huge business which the Government will both organise and invest in. That could be true as long as the Government grasps control over Korea Telecom. In practice, however, the environment is not as simple as when Korea Telecom planned the B-ISDN project. Fierce competition is already being introduced, with the expectation of attracting full investment from capital in telecommunications (see section

9.2.2). In the Master Plan, the strategy that "the government will make efforts to promote the participation of the private sector"[65] is presented (KII Task Force, November 1994). On the one hand, the Government should make Korea Telecom invest in KII, but on the other, it needs to attract private investment. This dilemma has brought drastic changes to the Master Plan, as we will see in the process of specifying KII (see section 10.3.4).

10.2.3 Technology Development and The Role of ETRI

The master plan presents one of KII's strategies to "develop application services and main technologies in connection with industry, academia and public institutions" (KII Task Force, 1994). Technological development is a major aim of the KII programme yet present technological capability also constrains it. This section examines the technology development concerns of the KII programme reflecting existing technological capabilities.

The concern with technological development in the KII programme largely resides in promoting application technology for informatics, recognising that the existing informatics policy has not been particularly successful and has not gained political support (Source: Soh, Young-Jin, 17 January 1995).

Therefore, the technology development in the KII programme is more concerned with how to utilise technology rather than how to develop it. ETRI was given the role of planning technological developments within the KII programme. That role is well presented in my interview with a member of staff in ETRI:

> I only plan and make recommendations on potentially critical technological developments in the KII programme. Policy makers can accept or refuse our recommendations depending on their interests. So far, the policy makers have accepted our suggestions. We find out what the key technologies for our national competitiveness are as well as how to develop strategically - how to raise and distribute funds, how to organise developments. (Kim, Seong-Youn, 12 June 1996a)

---

[65] According to the newly established law for the KII programme, 'The Basic Law for Promoting Informatics', the principle of 'promoting private sector investment and fair competition' comes prior to the other principles of 'establishing institutions responding to the changing environment', of 'liberalised access and usage of information communications infrastructure', of 'universal service provision with availability regardless of districts and economic status', of 'sustaining safety of private life and intellectual property', and of 'promoting international co-operation' (Article III, The Basic Law for Promoting Informatics).

An interview with a member of staff in ETRI, who was working in the R&D strategy planning group, shows the focus on technological concerns in the KII programme. When I went to ETRI, a task force for technology developments within the KII programme had just been established (January 1995). The member of staff I interviewed was about to move to the new division.

> B-ISDN is nothing more than a 'transmission system'. When we construct KII, user requirements also determine the economic value of the technology. In other words, in the case of KII, the limitation on the technologies are not critical since they have already been developed and most are currently available. The point is whether the quality of service is high enough to require a new technology. Within KII, the new idea for technology development stems from the concern with service rather than with technology development per se. Technology development in KII should be oriented to 'public technology'. Our task within KII is to identify what the 'public technology' is. (Kim, Seong-Youn, 7 February 1995c)

The view presented above concerns user demand which, the respondent believes, will determine the success of KII. The problem is not a matter of technological availability but of its economic value. In other words, the issue is whether the demand for certain services is heavy enough and sophisticated enough to pay for the technology.

I visited this interviewee again during the second phase of my fieldwork (June 1996) and this time he had many things to talk about as he has devoted himself to the project for one and a half years. The interview was quite informative. Above all, the first interview took place when he was in quite a hurry in a messy office with lots of packed boxes around. As with many of my second-time interviewees, the next encounter was more like a friendly discussion than a formal interview. He still maintained his original view of the technology development plan in the KII programme. He described the direction of the technology development plan for KII as follows:

> I developed the method for identifying the technology we need in constructing KII. The time schedule for technology development covers the second stage (1998-2002) of the programme, rather than encompassing the technology which we should develop ultimately. We started by considering whether the existing technology development strategy still works in developing the technology for the KII programme. We are taking into account the new variables in the changing environment which stems from the WTO system, opening up the service market and opening up the basic telecommunications service market.[66] We selected critical technologies for KII and identified eighty technologies which the Government should invest in (depending on whether the private sector is involved in the development process, or not), and whether the development holds to the

[66] See sections 9.2.1 and 9.3.1.

> requirements of the WTO system. I am very confident with the process we are pursuing to select the critical technologies. (Kim, Seong-Youn, 12 June 1996a)

This interview shows that the KII programme is firmly embedded in the more general changes being undergone by the existing R&D system, and by the opening up of the service and procurement markets under the WTO. In establishing the new technology development plan, it is essential to evaluate technological capability. This interviewee sees the technology capability of telecommunications in Korea is sufficient to act as a foundation for the ambitious KII programme. ETRI evaluates that Korea's basic level of technology in telecommunications is 70% of that of the advanced countries in the world, whereas STEPI [the Science and Technology Policy Institute] evaluates that Korea's capability is only 35 - 50% of that of Japan, including its industrial technology capability. The gap between STEPI's and ETRI's evaluations stems from the fact that STEPI includes industrial technology capability whereas ETRI only takes public institutions into account. Industrial technology capability is still problematic (Source: Kim, Seoug-Youn, 12 June 1996a).

The technology development plan in KII does not cover the existing technology development process. To be specific, the direction of technology development in the KII programme is focused on the deployment of services using technologies rather than on technology development per se. The interviewee continues:

> Our plan for KII does not include existing technology developments which are supposed to comprise KII. We focus rather on what we should develop more specifically for KII. Everything is related to KII actually. So that the technology development in the KII programme is focused on deployment rather than R&D itself. I don't think technology developments in the KII programme will produce new technologies. Ultimately, with the advanced network in KII, we are promoting our economy. Because others are doing that. If we lose ground on the super-highway, we cannot catch up with world markets. We are in a hurry. (Kim, Seong-Youn, 12 June 1996a)

The direction of technological development in the KII programme is focused on the deployment of technology. The interviewee explained the background:

> I think it is a very critical change of focus to look at deployment rather than development per se. The focus on deployment means establishing how to make people comfortable with using the technology. In other words, the development focuses on usage and application rather than on producing equipment. Look at N-ISDN, it has currently less than 10,000 subscriptions, although we already have the technology. The focus on deployment is possible partly because the private sector covers technical developments in the area of equipment, and the national

> strategic R&D programme is directed towards basic research. Our focus on deployment is a sort of niche within this context. Thus, we have got to focus on applications and usage in the KII programme. (Kim, Seong-Youn, 12 June 1996a)

Does Korea already have sufficient technological capability in the area of advanced telecommunications? If not, will the development of new technologies be pursued further? The notion of indigenous technology is, he said, 'taken for granted'.

> The basic premise about technology development is still that of possessing our own technology. Otherwise we cannot compete. I do not think Saudi Arabia needs to develop its own technology as they can afford to buy advanced technology any time. Possessing our own technology is a matter of living or dying. The technologies are available, although we do not have all of them. The technology comprised in the network is already being tested. The problem is finding the funds to invest in the subscriber loop. Because of the lack of a market, network operators will not invest in it. (Kim, Seong-Youn, 21 June 1996a)

So, the direction of the technology development plan in the KII programme focuses on improving the economic value of technology by supporting applications and usage-oriented technologies, which are expected to contribute to creating demand. That Korea should possess its own technology is still a fundamental principle. The interviewee continued:

> We have always aimed to be the second runner in the race because we have just followed something other countries have already developed, in terms of products and markets. We are judged to be strongly competitive in the area of domestic electronics. But domestic electronics only account for 1% of the KII programme. The market for services will be deployed, which means that other countries will enter that market. We have capability in digesting the technology, as you can see in the case of TDX development.[67] Our capability in this respect means that we may perpetually come second. If we stay at this stage only, many companies from other countries will enter the profitable business areas, and the protection of domestic industry is limited in the new environment. There is no space for late-comers to enter the market after the first runner has already exploited the Korean market. We could enjoy advanced services, but that does not necessarily mean that we could also enjoy national well-being based on our own competitiveness. Our task is to seek a solution for that problem. (Kim, Seong-Youn, 12 June 1996a)

Although the KII programme has positioned itself in relation to the whole telecommunications industry, its practical side resides in the development of technologies related to applications and usability. This is a significant part of the technologies deployed within the KII programme as it looks at the user demand side. This also involves restricting the role of ETRI given that ETRI is not supposed to be involved in technological development for commercial product under the WTO system.

---

[67] See sections 8.4 and 11.5.3.

In fact, as the KII programme proceeds, the notion of indigenous technology can be problematic in the sense that the plan for KII is promised on the idea that it should be supported by technologies developed internally. An interview with a member of staff shows the dilemma.

> In fact, the technology development of the 2.5 Giga bit fibre cable has been developed on a national basis. Well, we can buy it on the foreign market. But, the KII programme should devote itself to national technology development. If indigenous developments are delayed, that may influence delays in the KII programme. (Oh, Kwang-Suk, 19 June 1996a)

Korea still keeps the notion of indigenous technology in its national initiative for network evolution. The new world trade order provides an uneasy environment on the one hand and, on the other, improving the network function requires technological developments. How national technology capability keeps pace with the national initiative for network evolution is not yet visible, but it will remain a dilemma for the foreseeable future.

10.2.4 Constraints and Practice

The conditions which constrain the KII programme can be discussed under the two headings: whether the demand for advanced services are mature enough to require a high-performing network; and whether current technological capability can come to match the ambitious network construction plan. The concern about demand, in fact, is often intertwined with that of long-term infrastructural investment. National competitiveness is highlighted as the background of the programme as informatics is considered to be its focus. KII is perceived as a new social infrastructure which is expected to bring about the development of the nation; and, it is also expected to create new markets, to generate employment, and to reinforce industrial competitiveness.[68]

The lack of immediate demand and concerns about constructing a SOC need to be resolved in the policy. The KII programme consists of two distinct network constructions in the 'national information network' and the 'public information network' in terms of initial

[68] According to the official forecast, if 452,443 hundred million Won ($1=750 Won) is invested by 2015, the effect of creating production will be 613,000 hundred million Won for the information and communications industry, and 386,000 hundred million Won for the other industry; in sum, 100 million million Won for production; 560 thousand new jobs; and 3.22 % increase in GDP are expected to be realised.

investment and usage from government organisations. The concern about technology capability is implicated in achieving the programme, in that establishing application and usage-oriented technologies development is expected to contribute to achieving the KII programme.

So far, I have examined what constitutes the KII programme. The KII programme experienced a drastic change in that the Government invited private sector participation in the KII construction through introducing competition in local telephony services and through relieving the burden on Korea Telecom in changing the design of the network. The next section examines this process to reflect the political and economic interests surrounding KII.

10.3 The Process of Constructing KII

The purpose of constructing KII is often discussed within the concept of 'infrastructure', which is conceptualised as SOC (Social Overhead Capital). SOC, in general, indicates that portion of the necessary work which the private sector is not willing to invest in given the difficulty of making profits, despite the necessity for overall production activities as a function of input or as support for the other industries. In the case of the telecommunications industry, it offers infrastructural support to other industries, and it is also a highly profitable industry in itself. The tension between sustaining state control and inviting private investment emerges in this peculiarity of the telecommunications industry.

Telecommunications as a highly profitable industry has become prominent recently, whereas it existed in the form of 'public service' for a long time under the concept of SOC and the provision of universal service. Discourse on KII often confuses the two contents as KII was embarked on the middle of the battle between the two definitions - a battle which has not yet been resolved. The main players, such as MIC, Korea Telecom, the newly emerging potential or present network operators (or service providers), and related industries, are involved in the programme with different prospects and interests.

In this section, I will look at the KII programme mainly in terms of the political and economic interests surrounding it. This will reveal the dilemma between constructing SOC and developing the telecommunications industry as a highly-profitable industry. The dilemma in turn provides us with clues to understand the political and economic interests. The process of KII will be examined in five subsections; first, MIC's initiative-building in the future blueprint (10.3.1); second, the national information network and the role of NCA (10.3.2); third, the role of Korea Telecom (10.3.3); fourth, the realigning of KII by inviting private sector investment (10.3.4); and, fifth, the presence of universal service in KII (10.3.5).

10.3.1 MIC's Initiative Building in The Future Blueprint

KII is certainly a blueprint for the present political power structure. The blueprint supports the MIC's initiative in a way which recognises the synthetic figure of KII as infrastructure. MIC has been in charge of the KII programme since the beginning of the planning stage and, the complex features of KII reinforce the MIC's initiative.

In early 1993, MOC[69] began to be interested in the Information Super-highway project, looking at the case of the USA. In the autumn, MOC held some workshops within some telecommunications organisations. After that, the project became a national strategic project. The project focused on the construction of a physical network, with MOC in charge. With the focus on network construction, MOC managed the project initiative on behalf of other government departments by establishing an internal task force. The Blue House (the Korean President's House) also considered it as a potential political achievement (Source: Soh, Young-Jin, 17 January 1995).

The concept of 'network' changed into 'infrastructure'. One can easily suspect that 'KII' is simply named after the NII (National Information Infrastructure) project in the USA. However, a different trajectory is found in the process of developing the idea. In the case of the USA, in the beginning the super-highway project was no more than technology

[69]MOC (Ministry of Communication) is the previous title of MIC (Ministry of Information and Communication)

development, starting with the concern about NREN (the National Research and Education Network). Afterwards, it changed into NII (National Information Infrastructure), which is more concerned with the telecommunications infrastructure than with technology development per se.

In the case of KII, through a draft of the MOC report in March 1994, the project was first defined within the concept of a telecommunications network (MOC, March 1994). The final plan, which was produced in November 1994, employs the concept of infrastructure including both technology and social development (KII Task Force, November 1994). KII starts from a concern about network construction rather than about developing multimedia technology and a database industry. The fact that network construction enjoys a high profile in the programme from the outset is rather natural, as the initiative for the KII programme lies in MIC's hands.

MIC's initiative on KII initially came from the fact that MIC could get the resources to funding the programme by selling part of the Government's share of Korea Telecom's stocks. As a practical motive, the privatisation of Korea Telecom was a factor involved in launching the programme since the Government was searching for a way to invest the money it had earned from selling its stocks. MIC, in charge of stocks, was trying to invest in the telecommunications sector so that its power could be retained and strengthened. The super-highway project was propelled by the need for the large-scale government investment. The other government departments have been involved in the project in order to share out that investment; and, the project became the reconstruction of the social infrastructure (Source: Yoon, Tae-Sup, 16 January 1995).

If we look at the change in concept from 'network' into 'infrastructure' in the Korean context, we find factors which have affected the power relations between MIC and the other government departments. The power relations between them, in fact, represent the power relations between existing initiatives and newly emerging initiatives in the changing environment of the telecommunications industry in which the fields of computers and communications merge.

The 'network' was emphasised in the initial process of getting the programme off the ground; 'infrastructure' was suggested in the process of enlarging the initiative mid-way; and finally the focus on 'network' still remains in practice as the power relations between government divisions has not yet settled. Although MIC tried to gain the initiative over related industries other than the telecommunications network with the concept of 'infrastructure', it was still difficult to align all these tasks in an overall industrial policy.

MIC finds itself in the centre of the programme and the MIC's initiative was supported in the process of reformulating government in 1995. Through the reformation, the title of MOC changed to MIC (Ministry of Information and Communications), which became more powerful than before by gaining control over some of the key functions of other government departments: the function of the telecommunications apparatus and the equipment areas from the Ministry of Commerce and Industry; the software industry from the Ministry of Science and Technology; and CATV from the Ministry of Public Advertisement. This reformulation also reflects the phenomenon that the telecommunications network, the multimedia industry, the software industry, and the telecommunications equipment industry have become intimately related. The KII programme, in fact, propels the phenomenon by integrating the organising functions and placing it under the control of the Government.

MIC is now seen as having the role of organising and leading the multimedia industry, as well as being the regulator of the telecommunications sector. The change results from the changing status of the telecommunications industry. An interviewee in NCA points out:

> The Minister of MIC, Lee, Suk-Cha, who was recently appointed,[70] is a professional not in the area of telecommunications but in the area of macro economics. That means that MIC becomes an economic department, which deals with industrial development within the government, rather than only being concerned with telecommunications. (Yoon, Tae-Sup, 11 June 1996a)

The initiative, however, experienced another change. When I went to Korea for the second field trip, the KII programme was receiving less press coverage. Above all, I found there was another turning point with respect to its concept and organisation. The critical change I

[70] In the beginning of 1996

found was that the KII programme became explicitly focused on physical network construction, and the rest of the concept became separated from the KII programme, moving to the newly developed scheme - the 'plan for promoting informatics'. An interviewee points out, "I think this phenomenon results from the lack of demand and the lack of co-operation among government departments" (Cho, Yong-Kil, 11 June 1996b).

It is true that organisational change often comes from a change in strategy. The interviewee above identifies lack of demand and a conflict between government departments which are not happy with MIC's initiative to take control over their domains. In other words, MIC tried to address industrial and social policy in the name of creating demand under the KII programme, but, now, turns the focus onto the construction of a network and informatics policy.

A responsible member of staff in the KII Task Force, delegated from MIC, explains the background in an euphemistic way:

> In the beginning, MIC tried to cover all the related projects through constructing the network in the KII programme. But now the KII programme focuses on the construction of the physical network and the Plan for Promoting Informatics covers policy matters. Having said that, because of the KII programme, people came to understand the importance of a systematic plan for informatics, which includes networks, usage, creating an environment and technology development. The organisational change, in fact, is for creating a new container which accommodates the systematic administrative work for an informatics policy. The establishment of the Informatics Planning Division in MIC is, I believe, the institutionalisation[71] of the KII programme. KII is one element which comprises informatics. (Cha, Yang-Shin, 11 June 1996c)

The interviewee above emphasises the dialectic change in the phenomenon, rather than looking at the phenomenon in terms of the concept of KII returning to 'network'. Above all, the contents of KII are still covered by the new scheme, the 'plan for promoting informatics'. However, the change still implies that the KII programme does not cover industrial and social policy other than network construction, despite the fact that MIC now controls multi-media industry and technology development in the area of information and communications.

---

[71] The legal status of the KII programme has been changed from the early stage, which used to be in the form of a Presidential Command. The special law for KII has been established in the title of 'The Basic Law for Promoting Informatics'.

Now, after two years have passed, players see the reality of the KII programme. An interviewee I met again in the return visit describes the achievement of the programme over the two years.

> In the beginning, the other departments in the Government had a sort of alienated feeling. Why does MIC want to cover all things? Now all departments have plans for informatics as the key plan in improving their performance in many areas. Two years ago, there was nothing like that. (Yoon, Tae-Sup, 11 June 1996a)

In sum, the telecommunications network was the core of the KII programme in the beginning; it integrated related industrial policies in the concept of 'infrastructure' in the master plan. KII changed back into telecommunications network construction, comprised in the 'plan for promoting informatics' which covers the other social and industrial elements as well as KII. MIC established the Informatics Planning Division which comprises the KII Task Force. That MIC has gained the initiative over the related industries reflects the changing features of the telecommunications industry which strongly connects to the computer and software industries and to broadcasting. The KII programme propels the institutionalisation which accommodates the changes in technology and industry.

10.3.2 The National Information Network And The Role Of NCA

The NCA (National Computerisation Agency) used to be in charge of the national computer network which provides data services for the government administration (see section 8.3). The NCA was given a significant role in the KII programme, and it became a major player in the area of the national information network as well as in supporting ideas and in planning the KII programme. An interviewee in NCA said:

> The NCA plays the role of organiser. The government is an accelerator. The common carrier tends to break the pace, as user demand is not visible. The NCA is expected to be the mediator in this situation. Korea Telecom should not play a role in organising as well. (Yoon, Tae-Sup, 11 June 1996a)

The main interviewee in the NCA, as well as in the Task Force, emphasised NCA's organiser role when I asked why the NCA should be involved rather than Korea Telecom, which is involved in constructing both national and public information networks. I interviewed him as a delegated member of staff from the NCA to the Task Force in January 1995, which was just after the KII programme was launched. I met him again in June 1996, and I found he was back in the NCA, and had stepped aside from the major role he used to play in the national information network.

Because the national information network, which the Government has invested in, still depends on the subscriber loop which Korea Telecom is in charge of, a key factor emerges in its relationship with Korea Telecom. In late 1995, there was trouble between the NCA and Korea Telecom in the contracting procedure about the national information network construction for 1996. Korea Telecom required changes in the network construction to relieve the burden on investment scheduled in the plan for 1996 which the NCA had established. Korea Telecom did not fulfil the network construction planned in 1995. The issue became fiercely contested in that the Financial and Economic Planning Board and the National Audit Board were involved in investigating whether the network construction was reasonably planned. What are the criteria for judging whether the investment is reasonable? That depends on how much weight the Government gives to investing in future network construction.

The achievements since the programme was launched, are still not very visible. The interviewee described the process:

> In fact the early deployment of KII has been delayed. The initial pilot service was expected to expand the use of multimedia equipment by government departments, which would lead to the demand for multimedia terminals produced by industry. But, it is difficult to expand the demand for multimedia because every department in the Government has its own existing tasks, for instance, improving teachers' salary and reducing the number of students in classrooms in big city areas, etc., which is visible. But the services in the KII programme do not offer something to show. (Yoon, Tae-Sup, 11 June 1996a)

Even government organisations, which are, MIC thought, easy to co-operate, are still difficult to persuade. Above all, Korean society needs immediate actions in many other areas besides launching informatics.

It seems that in the process of investigation and in the conflict with Korea Telecom, the interviewee took responsibility for the NCA's plan and resigned from the Task Force in that he said "it was better to change personnel to resolve the trouble" (Yoon, Tae-Sup, 11 June 1996a). I was not able to access the contents of the investigation by the Financial and

Economic Planning Board and the National Audit Board as it is confidential. However, the essence of the trouble between the NCA and Korea Telecom resides in the views and interests the players possess. This story represents the process of realigning the technological elements with network design. Korea Telecom's position has been widely accepted in the network construction plan and in the changing of the Master plan.

Another point was suggested by a member of staff in Korea Telecom. The NCA demands the Korea Telecom adopt cheap tariffs for services coming through the national information network, initially for government organisations. The government subsidises the tariff, but Korea Telecom still takes some of burdens (Source: Ahn, Seung-Choon, 20 June 1996).

A member of staff who now plays a role in the national information network in the NCA describes the matter:

> The national information network only covers the backbone of the network. So users should pay for the subscriber loop which Korea Telecom covers. We had difficulties in negotiating with KT. The tariff for using the national information network will be 40% of the present tariff of PSTN. (Oh, Kwang-Suk, 19 June 1996a)

The nature of the national information network is that it is the conduit for the provision of advanced services in the public domain, especially within government organisations. Government organisations become users of advanced services through the national information network, provided at cheap rates by Korea Telecom. The network is expected to create an initial demand and to encourage Korea Telecom to invest in improving the network.

In my interview with a member of staff in Korea Telecom, the interviewee tended to talk about the problems Korea Telecom broadly has in telecommunications rather than in the area of KII. He did not seem to take the KII programme very seriously although he plays a major role in network construction for the KII programme. In fact, the division he is working for is focused only on the national information network unlike what the title of the division, the Information Super-Highway Group, suggests. Apparently, the 'public information network' is developed in the Network Centre Division in Korea Telecom rather than under the KII scheme. This is understandable because the 'public information network' as distinct from the 'national information network', comprises access network construction which is Korea Telecom's main specialist area. I was actually struggling to address my main point, that is, what problems Korea Telecom have encountered in constructing the network in the KII scheme. He responded by addressing the problems which occurred in the process of constructing the national information network in a way only as they relate to organisational affairs rather than problems which reflect the fundamental differences between Korea Telecom and NCA in the programme in terms of their views and interests. He only said:

> There was not a very serious problem between the NCA and us. That's not important. And those things have already passed. Well, in the early stage of the national information network construction, we were not happy with NCA's detailed requirements. It is enough to know how much capacity they want, and where they want to have the network. They do not have to specify what technology we should adopt or which system we should install. Once they give us their requirements, the rest of the physical construction should be our job, whether we install ATMs or whatever. (Ahn, Seung-Choon, 20 June 1996)

A different view was indicated by a member of staff in the NCA:

> Korea Telecom is not happy with the intervention of government. Why? Well, I think the programme does not suit Korea Telecom's sentiment. KT has always been the main body in the business rather than being under supervision. I see the problem in the internal organisation of Korea Telecom, within which many different views on KII are still being raised. (Oh, Kwang-Suk, 19 June 1996a)

Although, both members of staff in Korea Telecom and in the NCA see the root of the conflict as a 'misunderstanding', the views presented above imply a rather fundamental difference in how Korea Telecom and NCA look at the KII programme. Korea Telecom still sees itself as a main body in network construction, and the NCA, on behalf of the Government, as a customer rather than as a supervisor. Above all, Korea Telecom is the main body to invest in the public information network, where the issue is becoming more complicated. The differences come from the self- identification Korea Telecom possesses, and the interests Korea Telecom has, rather than from a trivial conflict caused by lack of co-operation.

The conflict between the NCA and Korea Telecom, however, is not directly connected to the power relations in the KII programme. In the KII, the NCA is placed in charge of the national information network, rather than pursuing its own interests. I have come to the view that the nature of the conflict between Korea Telecom and the NCA lies in the relationship between the Government and Korea Telecom rather than the relationship between the NCA and Korea Telecom per se.

10.3.3 Challenges by, and Co-operation of, Korea Telecom

> The public information network is exactly what Korea Telecom is doing now. It will happen anyway whether or not the KII programme drives it. (Ahn, Seung-Choon, 20 June 1996)

The simple response above, which a member of staff in Korea Telecom commented, implies the nature of the public information network in the KII programme. In terms of investment, the public information network would go ahead even without the KII programme since it is not physically different from the B-ISDN project internally developed in KT since 1988 including digitalisation of the network and providing enhanced services.

In the pre-historic stage of KII, only two agencies, MIC and Korea Telecom were involved in network evolution. The simple environment was where Korea Telecom only operated the network and provided services in the public domain under the control of MIC. KII was launched in the middle of the change from this simple environment, and in some way, it propels the change since it becomes the most highlighted project as it is a national strategic task. B-ISDN was the network evolution plan, internally developed in KT, and now it is becoming the base of the public information network planned in KII.

To begin, let's see how KII is perceived in Korea Telecom. A member of staff in the NCA criticised Korea Telecom's lack of enthusiasm:

> I understand that Korea Telecom has internal debates as to whether KT should devote itself to the KII Programme. I believe that they will realise that the KII programme contributes to meeting its own interests in the end. The B-ISDN project is nothing more than a technology development project. It is difficult to create services only with technology. The KII programme is a social policy to create an environment. Do you think only a synchronised transmission system and an ATM switching system will encourage the development of services? Look at the N-ISDN project which started in the beginning of 1980s. That could have been well distributed if the project had had proper links with government policy. They should be delighted to have strong support from government. If they are against that, they must be fools. Some sections of Korea Telecom say, "let us alone, we will do something nice with our own money." Is that meaningful for improving the quality of a telephone office? They should see the user side which is a cultural, institutional and environmental matter. (Yoon, Tae-Sup, 11 June 1996a)

An interview with a member of staff in Korea Telecom, shows that Korea Telecom's dilemma is, further, a dilemma about the public information network.

> In terms of 'benefit of investment', KT does not have reasons to invest in FTTH planned in KII, for there is no demand. If KT was entirely privatised, KT would not invest. (Kim, Choon-Sik, 15 February 1995)

Above all, Korea Telecom has got to calculate the balance between investment and profit. Korea Telecom, which is supposed to invest in KII construction, is struggling with the new environment, which is also being propelled by the KII programme (see section 9.2.4).

From outside of Korea Telecom, how to operate KII with respect to institutional change to telecommunications and the position of Korea Telecom in the KII programme, are critical issues. The people who have been involved in establishing the KII programme, in particular, people outside of Korea Telecom, are not very happy that the B-ISDN project, internally developed in Korea Telecom, is seen as the essence of the KII programme. They say that B-ISDN project only refers to the construction of the network. A member of staff in ETRI, an early participant in developing the idea of KII, does not agree that KII is based on B-ISDN.

> Korea Telecom sees KII as the 'B-ISDN' project itself and this view supports Korea Telecom's interests. If we see the KII as B-ISDN, the KII becomes the exclusive realm of the common carrier, which would provide the existing common carrier with a privileged environment. Even in the B-ISDN project, there are so many applications which need a variety of services, that a space should be open to various private providers through abolishing institutional format change. (Ha, Won-Kyu, 26 January 1995)

The opinion the interviewee above suggests, in fact embraces the basic conflicts between Korea Telecom and the other potential service providers and network operators, and it represents the dilemma of KII. If Korea Telecom is privileged because it is in charge of the construction of the network planned in KII, the introduction of competition can be blocked. The interviewee above emphasises competition within the private sector including Korea Telecom, and this interpretation does not allow Korea Telecom a privileged position.

An interview with a member of staff, who is responsible for sustaining KT's position in the process of negotiation with competitors and the MIC, shows what Korea Telecom wants from the government for investment in KII and warns of stable investment in the network if the competition continues to be strengthened. My impression is that he has a very valid view of the problem of regulation and the concerns of Korea Telecom; but, of course, his explanation and opinion is biased towards Korea Telecom's own interests.

> If the Government requires KT to invest in FTTH, which is to be oriented to constructing an infrastructure rather than making profit, KT should be protected from competition. However, the competition in long-distance telephone services is now opening up to other service providers and that openness is likely to be strengthened in the future. If competition continues to be reinforced, it is difficult to invest in enhancing the network project. (Shin, Byung-Chon, 22 February 1995b)

In terms of investment, it seems reasonable that Korea Telecom considers the KII programme as its accomplishment. Conversely, Korea Telecom claims that it needs a privileged environment in terms of deregulation of KT and limited competition. The interviewee continues:

> In fact, the KII programme seems rather a burden to us. However, it becomes a matter of strong concern in the Blue House. Now, it cannot be avoided. Even for stable investment in KII, KT should be protected from competition and should be privatised in order to be free from the law[72] that allows the government to intervene in the management of Korea Telecom. (Shin, Byung-Chon, 22 February 1995b)

The interview below with the other member of staff in Korea Telecom, shows in more detail why Korea Telecom is frustrated by the competition.

> If we look at the network composition, there are nodes, a backbone network which connects between nodes, and subscriber access loops. Among them, the backbone network is now being improved by the substitution of fibre optic cable and will be completed by 1998. In the case of the backbone network, there is enough demand and sufficient well-advanced technology, which pushes costs down. The competition is focused on the backbone; for instance, competition in the area of long-distance and fixed-line resales. So, the backbone network has received over-investment. The new carriers are only interested in this area, as this area brings profit with only small amounts of investment, which the new technologies make possible. On the other hand, the subscriber loop requires a lot of investment. That is the Information Super-highway. In the case of the backbone, the traffic occurs at the same time, so that the price is coming down, while the costs to construct fibre optics for the subscriber loop is going up. But the Government does not provide any benefit for that. (Ahn, Seung-Choon, 20 June 1996)

Korea Telecom is faced with fierce competition because the telecommunications industry has become a highly-profitable industry. Korea Telecom, on the other hand, is still required to maintain responsibility for constructing the public information network as planned in KII regardless of demand within the logic of an infrastructure which the public information

[72] The Basic Law for Managing Government Investment Organisations

network will eventually contribute to building. For the time being, industrial capital is not likely to be interested in KII itself, for there seems to be only a small demand for the kinds of advanced telecommunications services conveyed through KII. This is also Korea Telecom's concern. If capital is allowed to provide telecommunications services, that will shape the future whether or not the Government endorses that shape. The issue of the privatisation of Korea Telecom and of introducing competition in the access network to KII has implications as to how the private sector participates in the provision of a public network and as to whether private investment is critical in constructing KII. We will see how these matters are resolved reflecting capital's interests in the next section.

10.3.4 The Realigning of KII by Inviting Private Sector Investment

The interests of capital in telecommunications largely concerns its participation as network operators and service providers, which were Korea Telecom' exclusive remit in the form of public service. When the master plan was established, government policy was to encourage the private sector to participate in long-term projects for multi-media such as developing high-speed equipment, software and applications. The policy still prevented the private sector from entering the telecommunications service market which is the main concern of the private sector in the notion that "the government will make effort to promote the participation of private sector" (KII Task Force, 1994).

Apparently, there has been no direct investment from capital in the KII programme. A member of staff in the NCA indicates the area in which capital is interested in the KII programme.

> The *chaebol* sees whether it can earn money from KII or not, in the fields of selling equipment, providing services or constructing the network. I don't think the *chaebol* has immediate interests in KII so far. The Government is organising it and inducing its investment by creating a market with the tools of regulation, tariffs and licensing with a specific strategy. I think the *chaebol* still sees uncertainty. (Yoon, Tae-Sup, 11 June 1996a)

The role of government which orients capital's investment is pointed out in the interview:

> I think we should decide whether multi-media will be oriented to PCs or the TV in terms of policy, so that industry can decide where to invest. In other countries, industry moves fast on its own terms to produce and launch a market, which will determine the standard. The four tiers of *Samsung*, LG, *Daewoo* and *Hyundai* are

eager to develop their own direction with a wide range of options collected by having information about the world market. *Samsung* has specialised in the area of semiconductors, *Hyundai* focuses on satellites, LG is now licensed as a PCS provider[73] with strength in the area of system and terminal equipment. In these circumstances, it is important for government to orient the direction which determines whether specific developments will be delayed or advanced, or will meet with success or failure. (Yoon, Tae-Sup, 11 June 1996a)

The interviewee sees capital's interests as being met in the new domain of industries which provide advanced services such as data processing and database services.

I am optimistic about the participation of the private sector. For example, in the beginning stages of KII, when we held conferences, only one or two hundred people came even if they were free but these days thousands of people come to such occasions although we require them to pay a lot. And a lot of information service providers are emerging, which means the new industry for KII is becoming visible. It is usual that telecommunications services need two or three years in the early stage of launching, and after that, an explosive demand emerges. You can see that in the case of paging services.[74] It takes time, anyway. I don't understand why people are arguing that we do not have enough demand. That is just the usual situation for telecommunications services. (Yoon, Tae-Sup, 11 June 1996a)

The matter of capital's interest in KII, however, does not reside in the newly emerging industries and in providing equipment to support the KII programme at the moment, but, in the area of telecommunications services. The KII programme was established by the Government without persuading capital and without negotiating with capital either. Now, all the Government can do is to attract capital's investment through the introduction of competition and deregulation as the market is already recognised as being highly profitable. Investment, however, is still problematic as the demand for advanced services is not sufficient enough to attract private investment. The expectation was that investment in KII would follow once the provision of a public network was open to capital.

The interviewee sees the significance of government policy on the regulation of telecommunications in deploying KII as follows:

We see the environment is not mature enough to induce investment from the private sector, such that the government chose to change the market structure so as to induce private investment earlier than was originally planned. The common carrier in the plan should not only be Korea Telecom. The massive investment goes into the subscriber loop, which is expected to be invested in by other new common carriers depending on the division of region, roles and services. In fact, introducing many new common carriers is the tool to stimulate Korea Telecom. The new carriers are not supposed to invest in the public network infrastructure. Rather, they are to

73 See section 9.2.2.

74 See section 11.3.1.

> provide services with the network facilities provided by Korea Telecom, which will get a lot of new routes for access charges from the other carriers. (Yoon, Tae-Sup, 11 June 1996a)

The interests of capital in KII now reside in the area of service provision as well as in equipment provision, which should result from introducing more competition in telecommunications. This view was suggested after the Government decided to introduce competition in the local access network. The MIC granted a licence to a new local telephone company, *Hanaro Telecom.* This certainly helps to improve the construction of a public network as one more common carrier is added.

Apart from licensing a general local access network operator, the Government tried to select companies which were to be specified as the 'super-highway network carriers' in July 1996. They were supposed to invest in the high-capacity and high-speed backbone network in selective areas such as industrial regions, ports and airports by using Korea Telecom's access network. However, the selection process failed because there were no candidates. The MIC considered cancelling the selection process as the business opportunities offered to the private sector in this area did not seem clear (Electronic News, 17 July 1997).

The Government resolved this situation by allowing 'super-highway carriers' to participate in local competition for voice telephony for inviting investment from the private sector. The KII programme became one of the main elements driving local competition in that the Government introduced competition in local access networks not only by licensing one more local telephone company, but also by allowing 'super-highway carriers' to participate in local access networks.

The Government announced a new policy for local competition in July 1997, which allows a 'super-highway network carrier' to enter the local access network. The Master Plan has experienced a drastic change by establishing different technological alignments as well as by changing the means of competition. Construction of the network with fibre optic cable is complemented by CATV, the WLL (wireless local loop: fixed radio technology) and the existing copper cable enhanced by xDSL.[75] The technological elements were also realigned from 2 Mbps bilaterally, into 64 kbps to access the services from customers and 2 Mbps to provide the services from carriers (Electronics News, 17 July 1997).

The fibre optic cable construction in the access network (FTTH) was also challenged in terms of a lack of demand amongst residential subscribers. The commitment to FTTH construction changed to selective construction of FTTH, FTTO and FTTC reflecting the demand. By changing the substantial technological elements and network design, the aim of completion of KII by 2015 has changed to completion by 2010, and the budget changed from 45 million million Won to 31.7 million million Won (Electronics News 17 July 1997). Realigning technological elements and modifying the time of completion reflects how the KII initiative accommodates technological changes and reflects Korea Telecom's position and the private sector's interests.

These changes emerged within a short time scale. The new institutions and the realignment of KII occurred as a result of challenges from newly emerging technologies and challenges from lack of demand. The network design of KII changed from constructing the access network with fibre optic cable in the beginning, into the construction of a complex network with CATV, WLL, the existing copper cable enhanced by xDSL. The most important factor is that the policy chose to promote KII network construction by allowing the private sector to enter into local competition.

During this change, the position of Korea Telecom has also been reinforced in the sense that the network construction comprises the existing voice network and the burden of investment has been reduced by lifting the requirement for FTTH. The private sector can take advantage by entering into local competition as 'super-highway network carriers'.

10.3.5 The Presence of Universal Service in KII

[75]Alongside fibre optic cable, technologies have emerged for increasing the bandwidth of copper circuits to 1.5 to 2Mbit/s (using HDSL/ADSL- High Density bit rate Subscriber Loop/ Asymmetric Digital Loop) to provide more economic solutions, if only in the short term. The KII programme began to adopt these technologies in realigning the technological tasks.

> Fibre optic cable is certainly expensive. As the technology develops, the cost will come down. So we begin with the area where demand occurs, like we find in the case of big buildings. (Ahn, Seung-Choon, 20 June 1996)

A political blueprint is realistic when it has a proper policy goal coupled with practical instruments. 'Universal service' is often employed to fill the policy blueprint in telecommunications, and the Information Super-highway project, represented by NII in the USA, or by KII is not exceptional. Universal service is seen as one of the principles to deploy the Information Super-highway Network with its commitment of 'availability'. If this availability does not consist of practical substance, universal service becomes hypocritical.

The process of planning KII does not show a deep concern about providing universal service despite the fact that it is presented as an aim in the plan. An interviewee in the KII Task Force raises the question as to whether universal service is actually aimed at telecommunications policy in Korea.

> Universal service can be an ultimate goal, I believe. In fact, in the planning stages of the super-highway project, universal service was not discussed in a practical way. In the case of the public information network, demand will lead the direction of evolution, which means that the network operators will install FTTH (fibre to the home) in the profitable area. Although the technologies are available, the cost of installing the technologies are too high for FTTH. (Soh, Young-Jin, 17 January 1995)

How are the concerns of the user rather than the public interest being met? The interviewee continues,

> In fact, the Task Force has never concerned itself with the user and it is impossible for ordinary people to participate in policy decisions. Therefore, the leading forces of the project consist of government, a small number of people in the policy domain and the telecommunications carriers, so that the construction of the network itself has been the main point of the project since the beginning. (Soh, Young-Jin, 17 January 1995)

A member of staff in the NCA believes that universal service within KII will come naturally in the end. When I asked him whether the policy is oriented to the interests of capital rather than users or the public, he responded:

> No, I don't think the aim has been changed. I think that the proper product can realise universal service in a way which provides the products with cheap prices and high quality, and industrial competitiveness at the same time. The

> technology capability of the industry can follow the market, which should be visible through a policy direction. (Yoon, Tae-Sup, 11 June 1996a)

The comment the interviewee made above represents how the players regard the public interest in KII. In their view with industrial competitiveness, the public interest will be realised in the end. The public interest in KII does not stand alone within the KII programme, as the programme does not, either. I will leave the discussion of the public interest for the analysis chapters (see chapters 12 and 13), in which I will try to build up an understanding of KII in the context of political economy.

10.4 Summary

The perspectives of SOC and highly profitable industry on telecommunications merge in the construction of KII. KII is a national initiative for network evolution, starting with the vision of constructing FTTH by 2015. The lack of immediate demand determines the strategy of KII construction, divided into a national information network with initial government investment, and a public information network with the improving of subscriber loops by investment of common carriers represented by Korea Telecom. Korea Telecom had established its own plan for investing in the B-ISDN network. The KII programme is a national initiative which builds an information infrastructure reflecting the newly emerging technologies and institutional changes.

The new technologies and the liberalisation of telecommunications are also challenges for the KII programme, embodied in the process of realigning aims and network design. The process of KII construction reflects the political and economic interests of the players and, so far, the new alignment apparently favours private sector participation by means of introducing access network competition and by demand-oriented network design. The public interests are not an explicit issue for the form of network design.

Chapter 11: The Case of Digital Mobile Communications System Development

11.1 Introduction

Mobile communications have been provided in a way which reflect market dominance; the high price and advanced function of the service has restricted subscribers. The network consists of wireless technology which connects to a fixed line for service provision in general. One of main features of today's network evolution, however, shows that the boundary between wire and wireless network is being blurred by technological innovation. In terms of regulations that rule the extent of competition and of public access, the two areas have been dealt with in different realms, although this has become one of the main tasks to resolve.[76] I would see mobile communications as part of telecommunications rather than being separated from the fixed telecommunications infrastructure.

The market-oriented nature of mobile communications seems to lead the change in telecommunications with respect to newly-developing technologies and the widely-expanding provision of services. Technology development in the mobile communications area, therefore, has somewhat different features from the telecommunications sector based on fixed line, with respect to the interaction between technology push and demand pull. Technology push has been a major force in the telecommunications sector, where the services are provided as part of universal provision concerns regardless of class and district, whereas in the mobile communications sector, demand has led technological development. We could attempt to differentiate the technology development process in the mobile communications sector from that in the telecommunications area on the basis of this general assumption, to identify how the mechanism of technology development works, and how these two areas are interacting, and will be evolving into an integrated future telecommunications network.

[76] Oftel in the UK concluded that mobile communications still should be differentiated from fixed line services with respect to market penetration (Oftel, May 1996).

In this chapter, I will look at the technology development process in mobile communications in a specific socio-economic context, Korea, to elucidate how 'social' and 'technical' elements are being integrated into the specific technology development, bearing in mind how this relates with the case of Korea Information Infrastructure.

11.2 Overview

If you go to Seoul, the capital city in Korea, you can easily recognise how widely mobile communications services are spreading in the everyday life of the people, even without looking at the statistics (see section 11.3.1). The portable phone and car phone using cellular networks which used to be popular mostly amongst business people have become more mass market commodities. The paging service is now a fashion and has settled down as a means of communication between people especially for the young generation as well as for business people. If you exchange your address and phone number, your paging number is expected to be given. This phenomenon has only emerged since 1993 while the mobile communications market has been steadily growing so far.

The phenomenon of a rapidly-expanding mobile communications market, coupled with technology development targeted on more efficient service provision, are found in many advanced countries. The development of mobile communications technology is focused on how efficiently to make full use of radio frequency as a limited resource. Digitalisation is already well placed as an alternative to the present analogue system, in a way which provides simultaneous and multiple access points for subscribers. The presently developing digital system is broadly divided into two; TDMA (Time Division Multiple Access) and CDMA (Code Division Multiple Access).

CDMA has been chosen as the national technology standard and its development is being facilitated in Korea; it is expected to allow more efficient provision of mobile communications services than TDMA technology and to make it possible for Korean manufacturers to own CDMA as a state-of-the-art technology. The decision to develop the CDMA system in Korea was made in a context where the TDMA system was already far more developed than CDMA world-wide. As a result, scepticism has emerged with respect to the time needed for the development and the prospects for commercialisation.

The development of CDMA technology was undertaken within the existing R&D system in telecommunications. Korea Telecom and Korea Mobile Telecom provide the funding; and ETRI organises the development on behalf of the MIC with guaranteed procurement to manufacturers which are chosen by government to participate in development and production. Development is conducted jointly with a foreign company, Qualcomm, which patented the original CDMA technology. This collaborative effort has a high profile in the situation where the mobile communications technology capability in Korea is claimed to be too weak for it to develop the technology on its own. The switching part of the CDMA system has been built up based on TDX-10, the state-of-the-art switching system in Korea, while the system was indebted to the radio technology from Qualcomm. Development was changed from co-operation into competition between domestic manufacturers, reflecting the growing power of the private sector. The competitive market place for mobile communications is likely to produce burdens and risks for mobile communications operators in procuring a domestic system, which has not yet settled perfectly in terms of technological safety and reasonable costs compared with the systems available in foreign markets.

In sum, the development of the CDMA system has been undertaken under heavy pressure from rapidly-increasing demand, as a means of digitalising the system. The heavy market pressure and the shifting balance of power relations between state and capital are embedded in the process of selection and development of the technology, coupled with the mission of 'state-of-the-art'.

In order to explore the whole process of the CDMA system development, we need to divide the process into two stages, the selection stage and the development stage. Factors surrounding the process of the selection stage and the development stage have specific sociotechnical implications, reflecting specific conditions and idiosyncratic purposes, in different ways and carrying different weight.

Those elements which influence the CDMA system development will be explained in a way which combines the two stages with categories[77] in order to understand how each element is eventually integrated into the whole system development. Firstly, I examine the category of 'market and industrial trends'(11.3). Second, the process of selecting CDMA is shown in terms of the categories of 'competing technology' (CDMA/ TDMA) and of 'player's perception - indigenous technology' (11.4). Third, the process of system development and installation is examined by looking at the roles and interests of participants and the category of 'collaborating technology - TDX-10'(11.5). Fourth, the presence of universal service in CDMA development is discussed.

These next sections explore the motives and the process of CDMA system development, starting by examining market and industrial trends.

11.3 Market and Industrial Trends

Why has this development taken place in Korea with such a huge amount[78] of investment? The heavy demand from the market is a critical element in understanding the initial intention. Whereas demand prompts the development to be undertaken, the current technological alternatives in the mobile communications area, and the condition of technological level at which Korea commences the development, together determine the technological tasks. This section examines the themes of heavy pressure from the market (11.3.1), the technological capability of Korean manufacturers in mobile communications (11.3.2), and the technological trend towards digitalisation (11.3.3).

11.3.1 Heavy Pressure from Market

Mobile communications services began to be provided in 1984 with an analogue mode of AMPS (Advanced Mobile Phone Service)[79] system, starting from Seoul; and, it has been expanding to the other big cities such as Pusan, Daegu, Kwangju and Daejon. In 1995,

---

[77]This categorised way to explain the elements of technology development process is based on a 'The diamond of inter-organisational alignment', suggested by Alfonso Molina (see section 1.2.2).
[78]See section 11.5.1.
[79]AMPS (Advanced Mobile Phone Service) is the most widely spread analogue system in the world, with which AT&T in the USA commenced commercial service.

subscriptions to analogue mobile communications services reached over 1,600,000 (Korea Mobile Telecom, 1996).

The emergence of a new form of telecommunications needs long-term preparation with respect to policy and technology. Regulation and policies have been deployed so far in the mobile communications area, reflecting rapidly changing features of the market (Table 11-1).

Table 11-1: Major Activities in Mobile Communications

1961: Pre-Cellular Mobile Service
1982: Paging Service by KTA (Korea Telecommunications Authority)
1984: AMPS (Advanced Mobile Phone Services) cellular service by KTA
1988: Korea Mobile Telecommunications Corp.(KMTC) was separated from KTA in the form of a public firm; the portable phone was introduced
1991: Deregulation and competitive market structures formalised in the whole telecommunications sector[80]
1992: Selection process[81] of the second mobile cellular operator, which eventually failed, and of pager operators took place.
1993: Adoption of the CDMA Digital Cellular system as national technology standard for digitalisation/ second pager operators began service provision
1994: Second mobile cellular operator was chosen

The mobile communications sector is now seen by both the general business community and the telecommunications community as the goose that lays the golden eggs. The share of mobile communications within telecommunications services has been rapidly expanding, whereas the growth of sale in fixed line services has become rather steady (Table 11-2).

The demand for mobile communications both in cellular phone and paging services is rapidly increasing, resulting from economic development and diversifying industrial activities (Table 11-3; Table 11-4).

80 See section 9.2.2.
81 See also section 9.2.2.

Table 11-2: Changing Features of Growth in Telecommunications Services[82]

(Unit: 1 million US $, ( ): percentage of the market)

Sector		1990	1991	1992	1993	1994
General	Fixed line	4,136 (95.3)	4,718 (93.6)	5,055 (90.7)	5,358 (87.4)	5,915 (79.6)
Network	Wireless	122 (2.8)	204 (4.0)	333 (5.9)	546 (8.9)	1,184 (15.9)
Services	total	4,258 (98.1)	4,922 (97.6)	5,388 (96.6)	5,904 (96.3)	7,099 (95.5)
Value	Added	82 (1.9)	120 (2.4)	183 (3.6)	275 (3.7)	324 (4.5)
Total		4,340 (100.0)	5,042 (100.0)	5,571 (100.0)	6,129 (100.0)	7,423 (100.0)

(1$= 707 Won in 1990; 733 in 1991; 781 in 1992;803 in 1993; 803 in 1994)

(Source: KISDI, 1995)

Table 11-3: Subscriptions to Mobile Phones

(Unit: number; ( ) -increasing rate %)

	1984	1990	1991	1992	1993	1994	1995
Seoul	2, 659	54, 021	108, 511	169, 804	278, 432	538, 343	865, 568
Others		25, 984	57, 687	102, 124	193, 352	421, 915	775, 725
Total	2, 659	80, 005	166, 198 (107)	271, 928 (63.6)	471, 784 (73.5)	960, 258 (103.5)	1,641,29 3 (70.9)

(Source: KMT, 1996)

Table 11-4: Subscriptions to Paging Service

(Unit: number, %)

	1990	1991	1992	1993	1994	1995
Subscrip-tion	417, 650	850, 515	1, 451,710	2, 272,256	6,362,478	9,658,635
Increasing rate	110.6	103.6	70.7	63.9	140.1	51.8
Penetra-tion rate	0.97	1.97	3.32	5.1	14.3	21.7

(Source: KMT, 1996)

[82] Table 11-2 is reformulated to show the changing weight of mobile market from Table 8-2, which shows the telecommunications service market in Korea.

The heavy demand for mobile communications has emerged only since the beginning of the 1990s. For example, the demand in 1994 ranks equal to the total demand of the previous ten years. The scale of the total mobile communications market is expanding at the rate of 60% a year in the domestic market, and 30% a year in the international market.[83] The introduction of competition in the mobile communications area caused rapid growth in particular in the area of paging services as well as mobile phone services at the average rate of 252% in the growth of sales between 1991-1994. Even if only the domestic market is considered, the value of the market is expected to reach one million million Won in the near future (Source: KMT, 1996).

The development of the CDMA system has been carried out in response to strong market demand. A digital system is considered as a technological alternative in terms of its efficiency of frequency use. The development of the CDMA system, however, did not have enough support from government until the explosive demand claimed government attention. Since the project was proposed by ETRI in 1988, it was dismissed once KMTC (Korea Mobile Telecommunications Co.)[84] was separated from Korea Telecom in 1988. Before the separation, mobile communications was not seen as a lucrative area. In 1989, the MOC began to support it as one of its national strategic technology development projects. In 1989 and 1990, basic research was undertaken with only 10 hundred million Won. The fully geared project with 500 hundred million Won started in 1991 (Source: Lee, Hyuck-Jae, 7 February 1995a). Digital mobile system development in Korea started by recognising the urgent demands of the market. It did not have a long term perspective, rather, it was chased by market pressure.

In 1994, the mobile communications sector in Korea experienced a drastic change with respect to the ownership of the single operator which had been a government-owned monopoly, when it also introduced competition by selecting a second operator (see section

[83]The number of subscriptions to the US mobile phone service in 1993 was 16,009, 461 (Mobile Communications, 24 March, 1994); that of Japan in 1995 was 6,232, 000 (Japanese Telecommunications, November 1995); and that of Britain in 1995 was 5,028,609 (European Mobile Communications, October 1995).
[84] KMTC is the previous title of KMT, which is now privatised. In 1996, KMT changed its name to SK Telecom.

9.2.2). The issue of change from analogue into digital was raised in relation to the selection process for the second mobile operator. In the first selection process held in 1992 (see section 9.2.2), the MIC required the analogue mode from applicants; but, in the next process taking place in 1994, the MIC changed the requirement from analogue to digital. The MIC argued that despite the superiority of a digital system, an analogue system was chosen to provide a stable service, since it was faced with a rapidly growing domestic demand for mobile communications in 1992 (Source: parliament discussion paper, 1994).

The time schedule for the digital mobile system development was rather tight as the government announced that providers would start digital service from 1996, when the second provider was supposed to start service provision. The second provider was licensed on condition that it should start provision of service from 1996 with a digital mobile communications system. That meant it had to be CDMA as the second mobile communications provider promised to purchase domestically-available equipment. Who could know, at that time, whether the digital mobile system development would work out successfully or not?

Despite the drastic change of ownership and the explosive demand, the technological development has been undertaken under a government initiative. The standard (CDMA), coupled with the requirement of compulsory procurement, was assessed.

11.3.2 Technology Capability in Korea

Radio communications policy in Korea has been constrained by its condition as a divided nation, meaning that policy concerns are focused on security and on controlling frequency rather than its efficient use as a resource.

Although the history of mobile communications in Korea is not short, the technology had not been well developed until the middle of the 1980s because of concerns about national security.[85] This circumstance led to a dearth of experts and expertise in radio

[85]One episode shows how policy restricted radio technology development. In late 1970, when the condition of telecommunications services seriously burdened by heavy demand, the Telecommunications Technology Institute developed and suggested to facilitate a digital radio technology in the trunk line between telephone offices as an alternative. The proposal was rejected by the Korean CIA's strong objection on the ground that

communications technology in Korea. On the industry side, only two companies, Maxon and International Electronics Mechanical Engineering, have produced some radio equipment for military use and for wireless terminal equipment since the 1970s (Seoul Economy News, 14 February 1994).

In this situation, foreign equipment gained the initiative in the wireless telecommunications area, garnering 63.8% of the market (see Table 8-4). Domestic manufacturing is at the level of OEM production or simple assembly through importing foreign accessories (KMT, 1996). KMT relies heavily on foreign manufacturers for equipment. Over 90% of mobile network equipment is imported from Motorola and AT&T. In the case of terminal equipment, the situation is a bit better since domestic manufacturers cover nearly 50% of the mobile telephone market, whereas Motorola sells 49% of terminal equipment.

Importing foreign equipment has caused a problem in that KMT relies on foreign manufacturers for sustaining and repairing equipment.

> The foreign equipment, although it is normally offered at a cheaper price, is not always good, because we have to rely on the foreign manufacturer for maintaining the system and software, which requires huge amounts of money. KMT, which has used the analogue system from AT&T and Motorola, has to call the technician from those manufacturers even for a trivial disorder, as those manufacturers do not open their original system technology. (Saw, Dong-Jin, 21 June 1996b)

However, KMT has developed its own capability in systems engineering. In 1993, KMT started to manage systems engineering by itself, independent from AT&T from which KMT had been procuring the equipment. Systems engineering is a critical technology which aligns the whole system including switching and Base Transceiver Station (BTS), and distributes frequency efficiently with proper network design. Systems engineering comprises 11% of the total price of the equipment (Seoul Economy News, 14 February 1994).

The technology capability in mobile communications in Korea was almost non-existent in the area of public R&D institutions and in private manufacturing. The CDMA system

---

Seoul is too near the DMZ (Demilitarised Zone). Through this kind of concern, the domestically available technology related to radio frequency had to be abolished (Seoul Economy, 14 February 1994).

development was also set up to build technology capability in the wireless area of domestic manufacturing. The need for technological alternatives caused by market pressure brought the Government and the carrier to seek a way to establish a stable technology base. The choice was towards substitution of imported equipment by domestic equipment even allowing for heavy pressure from the market. The next section shows the technological trend towards digitalisation as the preferred alternative.

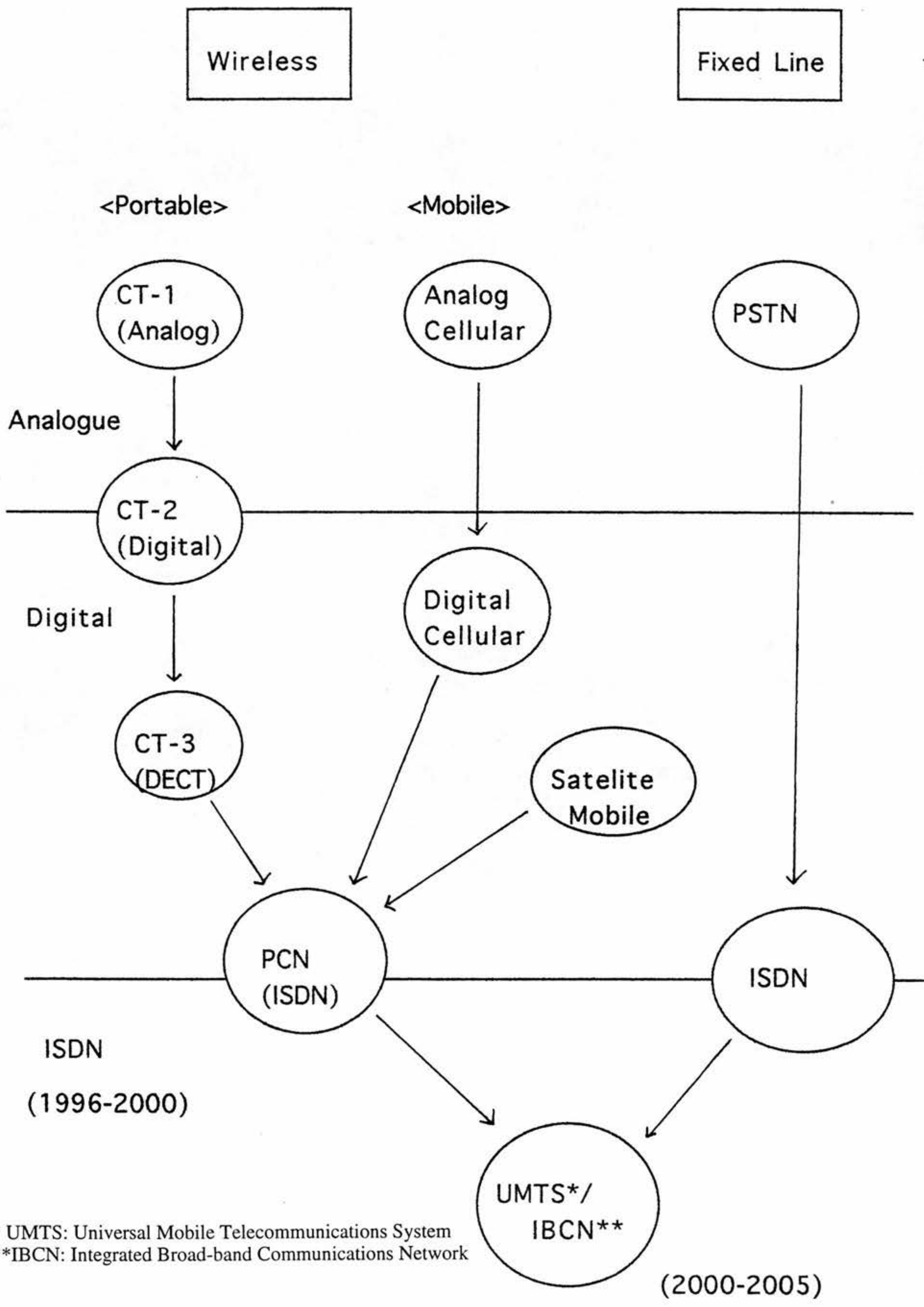
11.3.3 Digitalisation

Mobile communications have undergone three stages of development in terms of advanced technology: in the first stage, the AMPS (Advanced Mobile Phone Services) mode, the present analogue system is in use; the current second stage involves the development and installation of digital mobile communications technology; in the third stage, FPLMTS (Future Public Land Mobile Telecommunications System) is expected to realise UPT (Universal Personal Telecommunications) by assigning personal numbers to all individuals through an integrated network. PCS (Personal Communications Service) is considered to be the system which bridges the digital system with the perfect UPT. The future likelihood is that there will be integration between mobile networks, PSTN (Public Switched Telephone Network), and ISDN (Integrated Services Digital network) through international standards of telecommunications protocols (Figure 11-1).

If we look at the nature of wireless connection technology, being advanced means being more efficient at using frequency. 'Multiple access' technology has been developed to enable many people to use a frequency at the same time. FDMA (Frequency Division Multiple Access)[86] is a representative multiple access technology in the analogue system, whereas TDMA (Time Division Multiple Access) and CDMA (Code Division Multiple Access) are categorised in the digital system.

[86]FDMA allows reusing frequency in a way which divides spectrum into a number of channels with 12.5 -30KHz and allocates one channel to one subscriber in each cell.

Figure 11-1: Network Evolution of Mobile Communications



* UMTS: Universal Mobile Telecommunications System
**IBCN: Integrated Broad-band Communications Network

Digital multiple access allows a number of subscribers to use a channel at the same time, which has a wider scale of spectrum than analogue does. Digital technology is said to be superior to analogue in terms of quality of communications and economic efficiency. TDMA aligns and transmits digital codes entered by a number of subscribers in sequence through standardising the codes with a certain time scale to prevent overlapping. CDMA allocates a rather wide spectrum (1.23MHz) into one channel (1FA: Frequency Assignment) and allows a number of subscribers to use the channel at the same time, through sending a certain code. The code is transmitted into a signal which requires each side, the sender and the receiver, to be aware of the code. If the receiver does not recognise the code, the code is nothing more than noise.

At present, TDMA includes broad band TDMA in Europe, narrow-band TDMA in Japan and United States, and Extended TDMA being developed by Hughes in the USA. CDMA includes narrow-band CDMA proposed by Qualcomm in the US, broad-band CDMA being developed for PCS (Personal Communications Service) by Milcom and SCS Mobilecom in the east of the USA.

CDMA has been considered as a technological alternative in the digitalisation of mobile communications systems once Qualcomm succeeded in its experiments and claimed the potential of its high quality of communications in 1992. In 1989, when Qualcomm proposed the possibility of utilising CDMA for mobile communications for the first time, many professionals were sceptical and the possibility of commercialisation has since been in dispute. The key point of dispute was that, given that the proposal of Qualcomm could be appreciated in theory, the economic efficiency of realising the technology was challenged. At last, CDMA gained one of the US digital mobile communications standards in addition to TDMA in July 1993. At that time, TDMA had already been accepted as an alternative digital mobile communications system with respect to both the technology and the market. TDMA was seen as the alternative to have the greatest prospects for commercialisation and it is still the most popular system in the global mobile communications market.

The Global System for Mobile Communications (GSM), the European standard which has adopted the TDMA technology, is likely to become the dominant technology in mobile communications. By end of 1995, 156 mobile carriers in all the 86 countries which provide digital mobile service, provide services through GSM with 13 million subscriptions. Japan, although it is the largest user of telecommunications, has developed a proprietary cellular technology called PDC, which seems unlikely to be exported elsewhere (FT, 9 May 1995). The US telecommunications sector has been preparing to provide a CDMA system, as AT&T, Motorola and Northern Telecom have been developing the specific equipment for BTS (Base Transceiver Station), which accommodates both CDMA and TDMA, and even AMPS, by 1995 or 1996 (Electronics News, 21 March 1994). Korea is the first country in the world to commercialise a CDMA system in 1996 through its joint development project with Qualcomm. Qualcomm commercialised BTS control equipment in 1995 with a packet switching mode while ETRI and Korean manufacturers developed a switching system for CDMA on the basis of TDX-10 in 1995.

The heavy market pressure and the weak technological base determines the technological tasks for Korea: the need for the technology to have a higher capacity; and the need for technology transfer. The technology trend in digitalisation emerges as technological alternatives. The selection of the CDMA system was undertaken with the concerns about these technological tasks, combined with players' perceptions that Korea should establish its own technology base rather than importing the equipment. When Korea chose to develop a CDMA system in 1991, the CDMA technology was only dealt with experimentally. The next section shows the challenges faced by decision makers.

11.4 The Process of Selecting CDMA

In a situation where heavy market pressure prompts the need to find technological alternatives, players' intentions to possess indigenous technology became involved in the process of selecting between TDMA and CDMA. This section introduces the characteristics of both TDMA and CDMA, and the concerns and debates which occurred in the process of selecting the CDMA system.

11.4.1 Competing Technology: TDMA/ CDMA

The question of whether TDMA or CDMA is the better technology is not simple. When we talk about technological superiority, the topic covers many aspects, depending on what we assess and how much weight we give to differing features in judging 'superiority'.[87] One point can be technological solutions which enable us to judge the appropriateness to a specific requirement: for example, in the mobile communications area, an important feature is the efficiency of frequency use. A second point may lie in the safety of developing and installing the technology as a commercial product. Another can be the economic point of view, meaning whether the technology brings economic benefits to industry and consumers. If both technologies satisfy the second and third points, our judgement should focus on the first point, i.e. technological solutions. In this situation, the decision process should be simple.

CDMA technology was only available in theory rather than practice at the time when the selection process was undertaken. Because CDMA technology was not yet proven to be safe and successful in the market place, the debate continued even during the period of developing the CDMA system and it continued after its installation in terms of the standardisation of the PCS system, which is due for launch in 1998.[88]

This section compares between TDMA and CDMA regarding how the technical terms represent political and economic interests.

ETRI, which proposed the CDMA system development as well as organising the joint development, describes the technological characteristics of TDMA and CDMA as follows:

---

[87] These concerns will be dealt with in depth in 12.3.1 Political Embeddedness in the Notion of Indigenous Technology. Here, I only introduce possible perspectives on the competing technologies TDMA and CDMA as those concerns will be found in many places through the examination in this chapter.

[88] In 1996, the MIC issued PCS licences to three providers (see section 9.2.2), including Korea Telecom. The MIC required CDMA as its PCS service standard in 1995. Surrounding assessing service standards for PCS, many issues were raised, which brought about another debate about the selection of CDMA for mobile cellular services which had already been accepted. In particular, Korea Telecom had been preparing PCS service provision on the basis of TDMA with 810 million Won for technology development. Korea Telecom argued TDMA should also be the standard for PCS as well as CDMA but in the end, Korea Telecom chose to follow the government decision in order to gain its licence. The MIC argued that CDMA should be continuously developed as indigenous technology for future mobile communications services, PCS, with the accumulated capability from the CDMA mobile system (Electronic News, 21 October 1995). The service provision of PCS will begin in 1998, but it is claimed that if TDMA had also been allowed as a service standard, service providers for PCS would be able to begin service provision in 1997.

TDMA has three times the capacity of the existing analogue system since the technology can divide the existing frequency of one channel (30 kHz) into three sections, which allows three subscribers to use the one frequency at the same time. The CDMA mode can make the existing frequency of one channel (30 kHz - > 1.25MHz) spread and can align codes to each call, which allows a number of subscribers to use the same frequency at the same time with 12-15 times more capacity than the existing analogue mode can. The basic technology of CDMA, i.e. 'spread spectrum' communications, has been developed and is being used in the area of military communications.[89] The superiority of the CDMA system is described as follows (ETRI, 1992a):

> • First, the large capacity for subscribers make it possible to meet long- term demand, which can satisfy the likely demand of Seoul for the year 2,000 and beyond.
>
> • Second, the quality of communications is superb in that it uses 'rake receiver' technology which makes it possible to provide high quality service even in poor environments such as high level building and hilly areas.
>
> • Third, in terms of system operation, the usage efficiency of frequency is higher than TDMA, because the near BTS (Base Transceiver Station) can reuse the same frequency. CDMA allows easier and wider cell operation, so that the required number of BTSes is smaller.
>
> • Fourth, in terms of technology applications, CDMA has good potential to be extended to PCS (Personal Communications Services),[90] the future mobile communications services, wireless LAN, and satellite mobile communications.

These technological characteristics are also compared in the critique mounted by the Korea Society of Young Scientists and Engineers[91] (Table 11-5). While ETRI presents the superiority of CDMA system in technological terms, the Society countered the argument by highlighting the economic point of view and the safety concerns of commercialisation.

---

[89] In the past, The Defence Science Research Centre in Korea used to develop CDMA radio equipment. The basis of CDMA technology is 'spread spectrum' communication technology, which has been developed for military purposes after the Second World War and is also used for world wide satellite communications because of the security the CDMA technology offers. CDMA technology for mobile communications services was proposed, based on the other characteristics of 'spread spectrum' technology which can accommodate many subscribers on the same channel at the same time. The military communications technology, whose purpose is oriented to extreme security regardless of capacity and costs, has a different purpose from the mobile communications system technology, which aims to maximise capacity to accommodate subscribers at a low cost.

[90]ETRI started to develop PCS with the accumulated capability gained from CDMA development from 1995. Total funding offered by Korea Telecom by 2001 will reach 53 thousand million Won and domestic manufacturers are participating in the development with ETRI and Korea Telecom (Electronics News, 10 August 1994).

[91]The Korea Society of Young Scientists and Engineers is a civil movement organisation which young professionals in the area of science and technology established in the middle of the 1980s.

Table 11-5: Comparison of Technological Characteristics between TDMA and CDMA

Items of Comparison	TDMA (PCS -1990)	CDMA (IS- 95A)
Capacity of Frequency	•Efficiency of channel: 3 -7 times more than analogue •Spectrum per one channel: 200KHz •Capacity of system: 8 channel/ 200KHz	•Efficiency of channel: 10 -20 times more than analogue •Spectrum per one channel: 1.23 MHz •Capacity of system: 64 channel/ 1.23 MHz
Quality of Call	Degree of Clearness: 3.6	Degree of Clearness: 3.6
Rate of voice coding	13 kbps	8 kbps, 13 kbps (US Standard)
Hands off*	Stability	Unknown
Mobility	Low and high speed	Cellular: low and high speed/ PCS: low speed
Speed of data transmission	9, 600 bps	14,400 bps
BTS **	Small equipment realised (multiple channel per one modem), low price by using commercialised accessories	Disadvantage for small equipment (one channel per one modem), high price by using special ASIC*** and broad band RF****
Terminal Equipment	Small and light terminal realised/ using general accessories/ low price	Disadvantage for small terminal/ special ASIC, broad band RF/ high price
Royalties	Advantage in negotiation with a number of companies/ Low royalties from open standard	Disadvantage in negotiation with a monopolistic company/ High royalties from specific standard
Commercialisation	More feasibility as proven technology	Uncertainty as the development is being undertaken (PCS)
Market value	Broader market as a number of countries have adopted it	Narrow market as adoption is limited
Value Added Service	SIM Card/ Short Message/ Voice Mail/ Notice of sender	
Compatibility with other systems	Superiority	Disadvantaged

*The function of supporting communications when a subscriber moves to other cell sites where the interface between BTSes (Base Transceiver Station) is available, in other words, under the same system of the MSC (Mobile Switching Centre) **Base Transceiver Station, ***Application Specific Integrated Circuit, ****Radio Frequency

(Source: Korea Society of Young Scientist and Engineers, March 1996)

The debate surrounding the superiority of each technology was conducted in technical terms though from different angles. Even when the same factor is considered, advantages and disadvantages can be identified at the same time. For example, in terms of call quality, whereas ETRI argues that the CDMA system is of better quality, the Society argues that both systems possess the same degree of call quality. When the Society highlights the disadvantages of CDMA, the argument is mostly based on the fact that as a commercially proven technology, TDMA offers cheaper availability of related equipment. The Society argues that even this comparison is not fair because the elements it takes into account for CDMA are still only theoretical. The technological aspects presented by the different parties are not neutral, as factors can be seen in different ways. The Society does not represent any industrial players. Rather, it criticises the decision to select the CDMA system from a more general point of view. In that sense, this source has limitations in convincing us that particular technological terms embody a specific player's interests. However, it still provides us a means of evaluating how technical discourse embodies players' interests. We will see the more specific concerns of the decision-makers in the next section.

11.4.2 Players' Perceptions: Indigenous Technology

In the selection process of the CDMA system, the decision makers' concerns are based on the issue of possessing indigenous technology and on its prospects for export.

> TDMA is the technology which the advanced countries have already developed and commercialised, such that Korea can never catch up. In terms of technological self-sufficiency, CDMA has more potential (ETRI, 1994).

The issue of how the CDMA system can establish a market value was raised in parliament. Optimistic prospects have been suggested by the MIC, with respect to issues of economic efficiency and reliability. It is argued that although Korea is late in developing the system (which was due for completion in 1995) and does not currently have enough economic efficiency and reliability compared with US products, the level of synthesis technologies in the domestic commercialising system is expected to reach 70% - 80% of the US level by 1995. The key accessories and design technologies were being completed in domestic manufacturing and with continuing effort the commercialising system will settle down, so that the products of 1997 should be competitive enough to be evaluated at the same level as US products by that time. The MIC was also considering export possibilities. The argument was that AT&T and Motorola have the CDMA system technology in the world; but, Motorola does not have switching technology. By contrast, the CDMA system development undertaken in Korea will have a high capacity switching system and more BTSes (Base Transceiver Stations) than Motorola does, which is likely to bring about higher international competitiveness for the Korean system (The MIC's answer to the question raised by Cheong, Kyun-Whan, MP, October 1993).

This argument, however, can be countered by different angles concerning whether the CDMA standard actually contributes to national competitiveness. The selection process is directly related to establishing a national standard for digital mobile communications systems technologies and services. Criticism has surfaced on the rationality of choosing a single national technology standard for CDMA. An interview with a member of staff in *Shinsegi* presents this concern from the perspective of the service providers' position.

> I do not think that pursuing the national standard of CDMA helps national competitiveness. We cannot choose the system from the market to provide high quality service for our customers. If the government says "you use this!" we have to follow that. Then, what would happen in the environment of WTO? Would the foreign mobile telecom carriers which enter our mobile communications market have to follow the government's standard just like us? Let's look at the world market. How many countries actually use the CDMA system? Some parts of the US, and some parts of China. The Most prevailing system in the world is GSM. (Saw, Dong-Jin, 21 June 1996b)

The CDMA standard is a service standard rather than a technology standard per se. The problem related to a single standard of CDMA, from a mobile communications carrier's perspective, is that the standard the Korean Government chose has not yet been proven and well established.

The Society mentioned above also points out the risk of a single standard. The argument the Government presented which emphasised the positive prospects for export and market value which might accrue from an unique standard, is countered. The argument is that because of the unique standard it is difficult to enter foreign markets. Rather, Korea may become a targeted market for AT&T, Motorola and Northern Telecom, which are now developing a CDMA system with dual mode which can accommodate TDMA as well (Korea Society of Young Scientists and Engineers, 1996: 28). To overcome the short-comings of a single standard, it proposes that Korea should adopt a dual standard to include TDMA.

Samsung, one of the participants in the development, is known to have been against the Government's decision to select the system. A member of staff, who is in charge of the CDMA development team in *Samsung*, admitted:

> *Samsung* complained a lot about the selection of CDMA between late 1992 and early 1993 through seminars and public hearings. We were supporting TDMA, which, we believed, would take the shortest time to develop. We can rely on the capability of our analogue system, which only *Samsung* has got. (Hong, Soon-Ho, 15 June 1996)

In the USA, the issue of which system is more feasible and profitable has emerged in the process of forecasting and preparing a future mobile communications system. Mobile communications providers in the USA, however, do not appear to take the concerns about choosing a system very seriously, for they are concerned with the possibilities for commercialisation and for safety mainly in terms of profit. It suggests that if the mechanism of service provision works only with the factors of competition and market value, the direction of the system development and of utilising the system diversifies.

On the one hand, digitalisation is seen as a technological solution to the heavy demand for mobile communications services; on the other, CDMA development focuses on the state-of-the-art policy of technology in mobile communications. When the factor of heavy demand met the aim to possess indigenous technology, the decision was made to develop CDMA rather than to purchase a TDMA system from a foreign market or to develop an indigenous TDMA as a late runner.

Apart from the technological superiority of CDMA and concerns with indigenous technology, a circumstantial factor is found in the selection process. Despite the argument about the superiority of CDMA over TDMA and the better potential for indigenous technology found in CDMA rather than TDMA, it appears that CDMA was the inevitable choice for Korea. That is, a TDMA technology was not available from the other countries with respect to technology transfer. In late 1990, when ETRI started to explore a source of foreign technology for joint development, it found it hard to find a partner for joint development. Foreign radio technology was heavily protected, having also been developed for military communications. ETRI actually proposed joint development with a company which has TDMA technology but it was rejected (Source: Kim, Kwang-Ho, 8 February 1995a). There is an opinion that the reason why CDMA was chosen to be developed is that only Qualcomm made itself available, regardless of any questions of technological superiority (Source: Choi, Chung-Yul, 27 January 1995).

A member of staff in ETRI, who was involved in the CDMA system development, admits:

> CDMA is an excellent technology. And it is true that TDMA is also an excellent technology. At that time we selected a technology, only CDMA was available. In fact, in the process of supporting CDMA, TDMA tended to be under-evaluated. CDMA is just a wee bit better than TDMA. (Lee, Hun, 13 June 1996)

In hindsight it seems that the concerns players claim to possess in selecting the CDMA system, as discussed above, can be interpreted as post-hoc justification. This interpretation, however, could be facile in that it does not take into account the dialectic way we need to understand how people's concerns are articulated in developing a technology in specific circumstances. We cannot say that the fact that only Qualcomm was available is not critical. It certainly was. However, we cannot equally say that it was only this factor which was a determinant in selecting the system. If both TDMA and CDMA had been available at the same time, would a different decision have been made? Understanding the selection and development process is not covered by this question. It is essential to understand the selection of CDMA and of its joint development with Qualcomm as a process, which includes the concern about indigenous technology rather than simply being a circumstantial factor. It is more significant to understand what concerns are voiced, what difficulties are encountered and what circumstances are most pertinent.

11.5 The Process of System Development and Installation

This section will illuminate the features of system development and installation, i.e. what actually happened, to reflect each player's role and interests. I will profile the development in terms of its funding, organisation and chronology (11.5.1); second, the joint development with Qualcomm will be examined to assess the role of this company (11.5.2); third, the indigenous switching system, TDX-10, will be discussed as a collaborating technology in the course of developing the CDMA system (11.5.3); fourth, the role of ETRI and the new initiative of KMT will be introduced (11.5.4); fifth, competition among manufacturers in the course of development will be examined as an important feature of the development process (11.5.5); sixth, the roles and interests of carriers will be examined in the development and installation process (11.5.6).

11.5.1 A Profile of The CDMA System Development

The CDMA development has been undertaken on the basis of a joint development involving ETRI, domestic manufacturers and a foreign partner, Qualcomm. ETRI embarked on digital mobile communications technology research in January 1989 by studying its theoretical basis and by searching for possibilities for its development. ETRI started the first stage of joint development with Qualcomm in August 1991, which continued onto second and third stages until the end of 1994. The development was planned to be completed by end of 1995, and it was expected that commercialising the system with domestic producers would commence in the beginning of 1996. Because of heavy market pressure and a tight time schedule, the development was closely followed by the press and by the public. The development history of CDMA system is summarised in Table 11-6.

Those manufacturers which contracted Qualcomm for joint development each paid \$5.5 million advanced royalties for the system equipment (LG,[92] *Samsung* and *Hyundai*) and \$3 million for terminal equipment (LG, *Samsung, Hyundai* and *Maxon*[93]). Once those manufacturers actually produce the system, they are supposed to pay Qualcomm additional royalties for fifteen years: in the case of the system equipment, the royalty is 5.75% of the costs of production; and, in the case of terminal equipment, it is 5.25% of the costs.

The total investment reached 508,200 million Won (\$677.6 million: \$1=750 Won), including funding from KT and KMT - 86,100 million (\$114.8 million); royalties for Qualcomm - 38,900 million (\$51.86 million); domestic manufacturers' costs for

---

[92] LG is the new title of Lucky Goldstar.

[93] *Maxon* is a private manufacturer which has been producing telephone terminal equipment, especially wireless telephone. In my examination, I will not deal with *Maxon* which only got involved in terminal equipment, as the development process was actually focused on system equipment.

participating in the development - 22,800 million ($30.4 million)[94]; internal development costs in KMT - 58,800 ($78.4 million); domestic manufacturers' internal costs - 301,600 million ($402.1 million) (Source: KMT, 1995).[95]

1) A critical facet of the CDMA development, in its first stage of joint development, includes *defining the concept* of the system to be developed domestically, based on the core technology for CDMA provided by Qualcomm. The second stage includes *designing the system*, which needs the test and production technologies of BTS (Base Transceiver Station), and technological support and education for the software source code of RTS, which is expected to be used to develop a first domestic model. The third stage includes *detailed design* with which domestic manufacturers produce their systems, which includes improving CDMA's performance and integrating key accessories.

2) If we look at the network structure of mobile communications (Figure 11-2), the digitalisation of a mobile communications system refers to the wireless interface between BTSes and mobile terminals in cell sites.[96]

---

[94] To relieve the burden of heavy investment, the MIC allows those manufacturers to use the Funds for Promoting Information and Communications (see section 10.2.2) which allow for long-term and low bank interest rate loans for 70% of their investment.

[95] Unlike KMT's data, 81,100 million Won was invested in the data produced by ETRI and MIC, including 46,300 million Won of government funding. KMT says the data produced by ETRI does not include royalties, internal development costs of KMT and manufacturers.

Table: Development Costs of Digital mobile communications System

(Unit: 100 million Won (1$=750 Won))

year	Government investment			Joint research costs (Manufacturers)	Total
	Korea Mobile Telecom	Korea* Telecom	Total		
1989	0	4	4	-	4
1990	3	6	9	-	9
1991	18.6	23.9	42.5	-	42.5
1992	54.6	63.4	118	-	118
1993	19.5	88.0	107.5	100	207.5
1994	98	-	98	96	194
1995	64.5	-	64.5	79	143.5
1996	20	-	20	72.8	92.8
Total	278.2	185.3	463.5	347.8	811.3

* Korea Telecom stopped funding in August 1993 on the basis that it was not a beneficiary of the development. (Source: ETRI, 1994)

[96] A Mobile communications network comprises a number of 'cell sites' which are units of service districts. They are controlled by BTSes (Base Transceiver Station). When a subscriber moves by car or on foot, she or he is able to communicate by the connections between the 'cells'. That is why mobile communications service is often referred to as 'cellular service'.

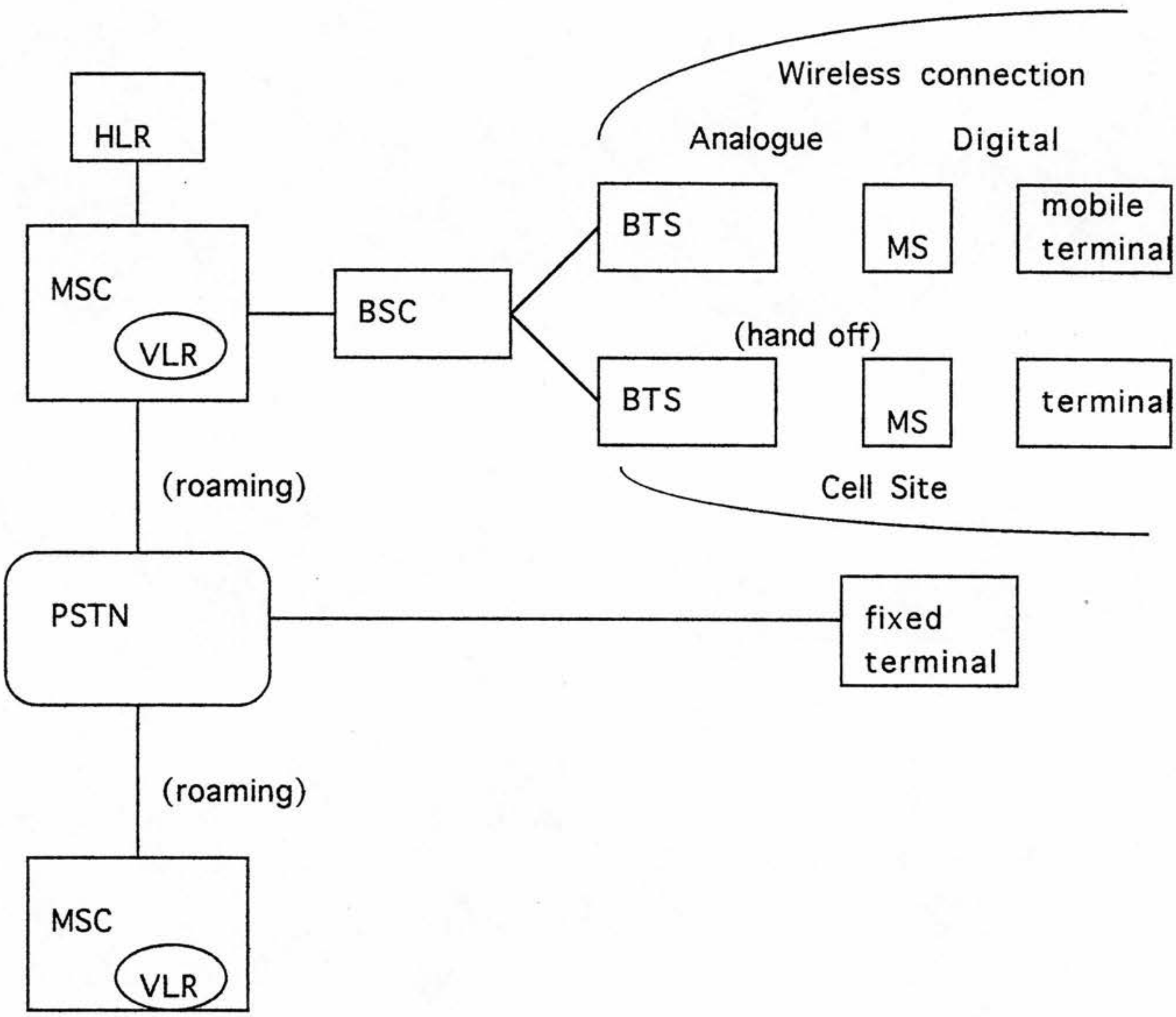
Table 11-6 : A Brief History of The CDMA System Development

	3) Process	1) Contract with Qualcomm	2) Technology developed (ETRI)
1989	Jan: ETRI begins to research digital cellular system		Theoretical
1991	Sep.: Start of Joint development with Qualcomm	First stage (Sep. 1991- Feb. 1992): $ 1.9 Million	Identifying CDMA concept and standard
1992		Second Stage (Aug. 1992 - Nov. 1993)	Dec.: RTS* Installation and Field Tested in Daejon
1993	Jan.: *Samsung*, LG, *Hyundai*, Maxon join the development through contracting Qualcomm Aug.: Task Force For Managing Mobile Communication Technology Development launches	: $10 million; setting up RTS in domestic base and experiment in field and designing network structure and system	Jan.: 3 DM** for Infrastructures and 4 DM's for Mobile joined Mar.: CMS*** System structures Designed Aug.: CMS - 1 (tested product: design completed) Dec.: CMS-1 System installed
1994	Apr. : Change of R&D structure from joint development into competition among manufacturers : LG declares independence Aug.: •*Samsung* leaves joint development • Testing pilot system produced by manufacturers in Seoul in KMT (Aug. 1994 - Sep. 1995)	Third Stage (Feb. 1994 - Dec. 1994): $ 5.05 million; detailed design of the system and documenting HW and SW design; focus on BTS, allowance to enter Qualcomm labs for Korean researchers, open meeting for sub-system, open research result of Qualcomm regularly	Apr.: Test of CMS-1 system (basic call), successful Oct.: CMS -2
1995	LG is chosen by KMT as equipment vendor; *Samsung* is chosen by *Shinsegi*		
1996	Jan.: KMT begins to provide digital mobile telephone service Apr.: *Shinsegi* begins		

* Radio Transmission System, ** Design Model, *** CDMA Mobile System

1) 2) 3): reference for explanation in the context

Figure 11-2: Structure of Mobile Communications System



MS: Mobile Station, BTS : Base Transceiver Station, BSC: Base Station Controller, MSC: Mobile Switching Centre, HLR: Home Location Register (the one of function if exchange system with which BTS check the subscriber's authorised use on the basis of subscriber's identity. HLR enables subscriber to move freely regardless of the subscribed location with the function of VLR), VLR: Visitor Location Register

The development focused on reformulating the existing digital switching system and adapting it to a mobile system. The new switching system adapted the TDX-10 system for a wireless environment as well as including a BTS and BSC as innovative components of the new system. The ASIC chip, the key accessory for BTS and mobile terminal equipment, is imported from Qualcomm. In sum, the development is focused on a mobile switching system and on BTS equipment, with transferred RF (Radio Frequency) technology from Qualcomm, and using the indigenous technology of TDX-10.

The development process is still on-going to address shortcomings and to improve performance, although installation of the system has already taken place. In fact, the developed system currently has 3-5 times more capacity than the old analogue system confounding the theoretical prospects (Source: Saw, Dong-Jin, 21 June 1996b).

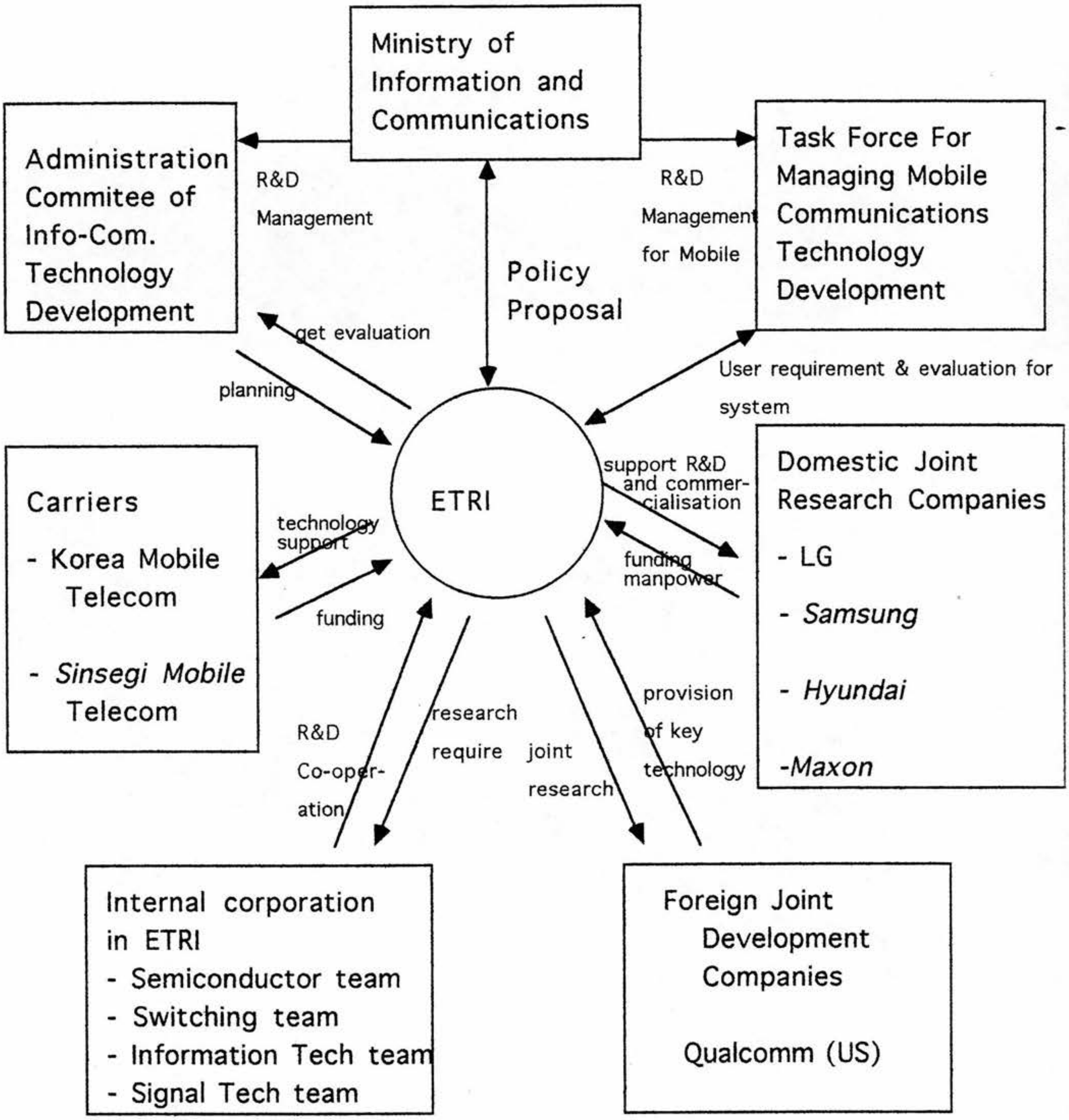
3) Figure 11-3 shows the formal organisation of the development. The actual roles and power relations of the players, however, changed throughout the process of development. If we look at the whole development process, there were several key turning points. The first was participation of the manufacturers (January 1993); second, the Task Force for Managing Mobile Communications Technology Development was launched (August 1993), independently from ETRI's involvement; third, the joint development system started to dissolve into competitive developments among manufacturers (April 1994).

Four domestic manufacturers, *Samsung,* LG, *Hyundai* and *Maxon* were selected to participate in the CDMA development through competition and each of them individually contracted Qualcomm for joint development. After the contracts were in place, the actual development was transferred to those companies from ETRI.

The Task Force For Managing Mobile Communications Technology Development (i.e. 'the Task Force') was launched to stimulate development on the basis of evaluations of the previous development process. The Task Force actually comprises staff from KMT, which came to control the initiative for the development.

The change from joint development into competitive development was stimulated by the Task Force, which declared that KMT would purchase the system on the basis of competition rather than on guaranteed procurement. LG walked out from the joint development system first (April 1994), and *Samsung* followed (August 1994). *Hyundai* remained in the relationship with ETRI until the development officially ended.

Figure 11-3: Structure of The Joint Development System



* This figure shows only formal structure of Organisation

The system testing took place under KMT's initiative in the period of August 1994 - September 1995. During the testing, *Samsung* left the testing base of KMT as it had won a procurement contract with *Shinsegi*. LG was chosen by KMT as the equipment vendor.

Hyundai completed the testing in the end, looking forward to the second procurement process.

KMT and *Shinsegi* started service provision with the newly-developed digital mobile communications system, CDMA, in January and April 1996 respectively.

Apparently, the development was completed successfully. However, our concerns in this thesis do not lie in the issue of whether it was successful or not. Even for the definition of 'being successful', we need proper criteria to judge and those criteria depend on how we look at the phenomena. I do not intend to judge whether it is successful, or even to assess which judgement criteria are 'best'. I would like to focus on the implications of the phenomena with respect to changes which emerged in the process, by showing the players' concerns and interests in the process of the development. The next section examines the process in detail on the basis of contents I described above.

11.5.2 CDMA and Qualcomm

The joint development with Qualcomm was, in fact, a challenging opportunity for Korea. Who, then, is Qualcomm? What did each side expect to get from the collaboration?

Qualcomm has a reputation for developing advanced military communications and satellite systems. The joint development with Qualcomm was actually perceived to be rather problematic in the beginning, because it was not very well-known at that time. Qualcomm used to be a small technology service company. Since 1990, it has tried to change its identity into a venture company for technology development. Qualcomm was evaluated as lacking synthetic communications technologies for the development of CDMA as a synthetic system such as switching, fixed line and transmission technologies other than radio multiple access technology. Qualcomm had started joint development[97] with AT&T and Motorola a year before the joint development with ETRI began. In the CDMA development, Qualcomm was responsible for the RF (Radio Frequency) technology, which

[97] In addition, Qualcomm has joint research contracts with Northern Telecom, which has a BTS capability, a switching system capability and production technology in developing CDMA and PCS in December 1994 (*Geil* Economy News, 17 December 1994).

the Korean team used in its system development. It is argued that joint research with ETRI has benefited Qualcomm in terms of funding and with the enhancement of some of its synthetic technology (Source: Kim, Kwang-Ho, 8 February 1995a).

In the process of joint development with Qualcomm, Qualcomm actually intended to sell the system,[98] rather than transferring technology to help the Korean team develop the system indigenously. A member of staff in ETRI said:

> In fact, Qualcomm did not trust us. They even insisted on being solely in charge of designing BTS, despite the fact that ETRI was originally supposed to develop BTS using design data provided by Qualcomm. In the case of BSC, the functioning communication between BTS and MSC, although Qualcomm recommended its own developing system to us, we developed the system with our own capability from TDX technology. Qualcomm had a strategy to sell the CDMA system to Korea. (Lee, Hun, 13 June 1996)

However, the technological benefit from Qualcomm was still crucial, in that the critical technology issue - the 'interface' between the switching system and BTS was transferred; and ASIC, which is critical to MS and BTS, was imported from Qualcomm (Source: Kim, Sun-Young, 7 February 1995d). This point implies the technological dependency upon Qualcomm as Korea did not have some of the most critical technology for its CDMA system. In fact, this is an important technological point which raises the issue of whether the CDMA system is indigenous technology or not. Scepticism on this point is well presented in this interview:

> They say CDMA is an indigenous technology, then what is the definition of indigenous technology? As far as I know, we buy the key chips from Qualcomm. I don't think it is really indigenous technology. (Saw, Dong-Jin, 21 June 1996b)

The technological dependency which is implied by the fact that domestic manufacturers are supposed to buy ASIC from Qualcomm, actually created trouble in the area of service provision as well as of manufacturing. An interview with a member of staff in *Shinsegi* complained:

---

[98] Qualcomm established its direct branch in Korea, Qualcomm International, to reinforce its marketing function in October 1995 (Electronic News, 18 October 1995). Qualcomm is actually selling its terminal equipment to Korean customers since the digital cellular service was launched. I came across a whole page advertisement in a newspaper, when I went to Korea on my return visit (June 1996). The advertisement emphasises that Qualcomm is the company which offered the original technology to Korean manufacturers.

> The reason why the distribution of terminal equipment has been delayed is that Qualcomm, upon whom we rely for the key chip, delayed their development.[99] Well, I suspect that they were also in a hurry. What happened is that we were not able to get customers because the terminal equipment was not available even after we began to provide services. (Saw, Jung-Won, 21 June 1996a)

In fact, there has been incessant scepticism[100] about the joint development, raising the issue that royalties for the technology transfer have been too much, taking into account the substantial benefits Qualcomm provided. Concerns were raised that the equipment could have been imported from overseas markets, suggesting that TDMA was more feasible in practice, although the technology development was successfully implemented (Korea Radio News, 28 March 1994).

ETRI argues that it was inevitable that royalties be paid to Qualcomm, for the basic mode technology of Qualcomm is patented.[101] The royalties for technology is based on a specific rate of costs in producing equipment to which CDMA technology is applied (equipment: 5.25%, system: 5.75%). What ETRI suggests to reduce the royalty is to reduce the costs in production by improving the integration of the system. Therefore, ETRI says that it was developing related technologies for a high integration of the hardware unit related to the CDMA technology (ETRI, 1994).

A member of staff in KMT finds the problem of royalties lies in the unfairness of the contract, rather than in the issue of technological dependency:

> I know we have got to pay royalties. What frustrates me is the level of royalty, which, I think, shows ETRI's irresponsibility. If I had been in the position of ETRI, I would not have forged the contract like that. I do not think ETRI had done a proper analysis of revenue and expenditure. That's, I think, the limitation of a public institute ... You should appreciate how many people have devoted themselves to developing the CDMA system, even giving up sleeping time and their private lives. If you understand what is actually involved in developing the CDMA system, you would not raise that question. It is only the chip which we have brought from Qualcomm. The newly-introduced digitalisation is accomplished in the wireless interface between the BTS and the subscriber's terminal. The other parts of the mobile network are actually fixed-line which have already been digitalised with

---

99 Qualcomm postponed delivering the ASIC (Application Specific Integrated Circuit) chip which should have been integrated into the MSM (Mobile Station Modem) for the terminal equipment, which was supposed to be delivered by end of 1995, until March 1996.

100 An interviewee in ETRI joked about CDMA, referring to a 'code' between researchers, where they called CDMA 'Cikkrupgo (troublesome)', 'Dirupgo (bloody)', 'Meskkupgo (sick)' and 'Anikkopda (revolting/ disgusting in a cynical expression)'.

101 Qualcomm announced that it would transfer CDMA technology to the other Korean manufacturers with cheap royalty for development of PCS system (Seoul Economy News, 18 October 1995).

> TDX-10. So the development is focused on restructuring TDX-10 in a way which makes TDX-10 suit the wireless interface when it is connected to the BTS. The switching system for the mobile network and the BTS equipment has been actually developed through our own efforts. (Lee, Ju-Hyung, 17 June 1996a)

As the interview shows, the issue of technology dependency is often countered by the fact that the Korean team actually developed the system with the contribution of the new switching technology, TDX-10.

The next section examines TDX-10 as a collaborating technology in developing the CDMA system.

11.5.3 Collaborating Technology: TDX-10

The CDMA development consists of the radio technology of BTS from Qualcomm; the TDX-10 switching system from ETRI; and, the production of the whole body of the CDMA mobile communications system from manufacturers. The BTS does not include the functioning of the TDX-10; but, the BSC (Base Station Controller) adapts part of the control technology of TDX-10 in the development of the sub-system. And, in the case of the MSC (Mobile Switching Centre), the mobile communications function is developed on the basis of the basic function of TDX-10, so that one-third of the mobile communications switching system is the same as TDX-10, one-third has been developed by modifying TDX-10, and one-third has been newly developed (ETRI, 1992b).

The TDX system series has been under development since 1984, starting with the fully-digitalised TDX-1. The system was developed jointly by *Samsung* Electronics Co., LG Telecom, *Dongyang* Telecommunications Co. and *Daewoo* Electronics. It was initially commercialised in 1987. The further development of the TDX system has been subsequently undertaken to succeed in introducing the TDX-1B and the TDX-10. The TDX development has brought a wide range of derivative effects in related manufacturing industries such as semiconductors, computers and telecommunications equipment manufacturing. Among the four companies which participated in developing and producing the TDX system, only *Samsung* and LG were selected to participate in joint development for CDMA with the new participant, *Hyundai*.

TDX-10 is sophisticated: the system architecture consists of an access switching subsystem, interconnection network subsystems and a central control subsystem. The advanced nature of the system allows both voice and integrated services digital network switching, including an ISDN interface, packet handler and common channel signalling. The TDX system realises advanced functions such as automatic call distribution, customer premises switching, container switching and remote subscriber switching, all of which are widely in use both domestically and abroad. The sophistication and flexibility of TDX-10 allows it to realise newly-developed functions such as ISDN as well as the CDMA system based on it.

The capability to develop a CDMA switching system was supported by TDX-10 in terms of technological expertise as well as system components. A member of staff in ETRI, who has participated in the development since January 1993 and is responsible for the BTS development during the designing stages of CMS 1 and 2 says:

> I used to participate in TDX development. I believe the experience made it possible for me to identify the critical technology of TDX for the BTS design. We have got the switching and network technologies. Qualcomm has only the CDMA technology. It was new to us to support new technology development with our own technology capability. The switching system of CDMA is a result of our own development, whereas the BTS is a result of joint development with Qualcomm. (Lee, Hun, 13 June 1996)

As the development process became more focused on system development, the role of Qualcomm became less significant. The interview continues:

> In 1992 and 1993, we were in the position to learn from Qualcomm, but since 1994, Qualcomm's technology was considered just as a reference point. The technology from Qualcomm did not greatly influence the actual design of the system. When we were developing a commercial model, Qualcomm provided us with a reference and with chips, which we bought at that time. ETRI and manufacturers are now developing the chips. (Lee, Hun, 13 June 1996)

As the development was maturing, in other words, as the focus of development turned to the switching system, the joint development with Qualcomm became less meaningful, which, I also interpret as meaning that the role of ETRI in connecting Qualcomm with local manufacturers became less significant. Above all, domestic manufacturers have got the switching technology in the areas of development and production. The switching technology from the TDX system worked in a way which reinforced the status of the manufacturers. Increasingly, they found it less necessary to rely on ETRI, or in other words, on the joint development scheme. We will see this point in detail in the following two sections, which examine the roles and concerns of participants in the development process, starting with ETRI and KMT.

11.5.4 The Role of ETRI and The New Initiative of KMT

ETRI's control, on behalf of the Government, over the R&D structure was to achieve efficiency in organising the R&D. An interview shows how the process of development was carried out:

> The USA was sceptical about our development. In fact, by the time we developed CMS 1 and 2, Motorola was ahead of us. In R&D, I think the USA has a rather different approach. It takes Motorola more time to develop the system because it spends time on convincing people about functions developed rather than a development itself, by producing data on each function to prove the excellence of each technology. We had got Motorola's time schedule for development in advance and this indicated how to proceed. In our case, the proving function is next in line after the development of the pilot system. Manufacturers started producing just after the emergence of the pilot system. At present, ETRI is developing tools to evaluate functions. (Lee, Hun, 13 June 1996)

The manufacturers and carriers were supposed to act together under the supervision of ETRI working on behalf of the Government. This organisation reduced the formal procedures for persuasion. However, the role of ETRI changed as the development process has matured. A member of staff in ETRI described ETRI as a major player in developing a pre-commercialising system:

> Since the late 1980s, the R&D system has changed from ETRI's transferring technology to manufacturers into joint development with manufacturers. When a project's scale is large, it is likely to fall behind in the projected commercialisation time-scale, and it is difficult to afford development only using government funding. In the case of CDMA, we started research in 1989 but once the system actually had commercial prospects, we induced manufacturers join in the development. The manufacturers joined in time to prepare for commercialisation. ETRI played a role in designing the system, whereas manufacturers played a role in designing, producing and testing the prototype. (Lee, Hun, 13 June 1996)

A member of staff in *Samsung*, who is in charge of system development points out that the role of ETRI was not as significant as was supposed in general:

> I guess that ETRI thinks the CDMA system came out from the joint development between ETRI and Qualcomm. But we, the private companies, see it in a different way. Well, ETRI, the public institute, selected the CDMA technology supporting the national technology policy. After selecting the technology the process moved on to developing a product. In the process of developing a product, we need general telecommunications technologies such as networks, processors and software, which

> companies have already got over and above the core technology of CDMA. We did not have to rely on ETRI that much. (Hong, Soon-Ho, 15 June 1996)

Although ETRI and manufacturers give their roles different weights, they seem to agree that ETRI played a major role in the beginning stages of development and manufacturers played a vital role in the ensuing commercialising process. However, the status of ETRI certainly changed en route which brought about critical changes to the development strategy, and also to the organisation of the development.

ETRI did not appear to have enough power to control the manufacturers. Joint collaboration between companies was problematic from the beginning for these companies were eventually destined to become competitors with each other. The joint development system broke down once ETRI lost its power-broking position, a change in status which was signalled by LG's declaring its independence.

Since the emergence of a commercial model in April 1994, the joint development framework has actually broken down. Although manufacturers joined in the development process, the technical points they each concentrated on proved to be different. The pilot system is divided into two stage. CMS 1, completed April 1994, was the system through which the design would be proven to work and the next stage was then prepared, rather than a commercial system per se. By that time, the three manufacturers had established a division of labour in developing the system's functions. In the meantime, ETRI started designing CMS 2 in January 1994. In developing CMS 2, LG walked away from the joint development (Source: Lee, Hun, 13 June 1996).

The interview with a member of staff in ETRI describes this as a matter of the manufacturer's intention to be competitive in design:

> LG walked out declaring that they would differentiate their own system from others. LG's system shares basic functions with others, but has differentiated its system with respect to several functions. *Samsung* and *Hyundai* trusted ETRI's design. Thus, they intended to divide up development work continuously. (Lee, Hun, 13 June 1996)

The turning point from joint development into competitive development seems to reflect the stage of technological development reached. On the other hand, the organisational change to the development system was critical to this turning point. The initiative for the development was given to the carrier, KMT, from the public institute, ETRI. The new organisation, the Task Force For Managing Mobile Communication Technology Development, which, in fact, comprised staff from KMT, with the well-known leader, Saw, Jeong-Uk,[102] was launched in August 1993.

An interview with a responsible member of staff of a manufacturer reveals a different angle to ETRI's explanation of the turn in events:

> ETRI, who contemplated how to reorganise joint development, suggested new co-operation in early 1994, while the participants were thinking of competitive development after the joint development broke down in late 1993. LG said No. *Samsung* said O.K. Well, *Hyundai* had no choice.[103] Actually the development in 1994 was undertaken by ETRI and *Samsung*. We knew our research results just went to *Hyundai*. We did not complain, though. LG was actually prevented from accessing our research results. They did not sustain a relationship with ETRI any more. LG walked out in late 1993 rather than 1994. (Hong, Soon-Ho, 15 June 1996)

During the competitive development stage, partial joint development continued. The interviewee above judged that joint development broke down once the Task Force was launched, which, I think, is a more persuasive explanation than one which points to technology development stage per se. Once the Task Force was launched in August 1993, the strategy for development actually changed onto a competition basis.

The interviewee also indicates that the new form of organisation emerged from the general consensus that the development organised by ETRI had not been efficient enough:

> We started to participate from 1993. When we evaluated the research performance for 1993, it was unlikely that the project would be completed by end of 1994. When we actually built a system combining those technologies which had developed by that time, the resulting system was not reliable in operation. We complained strongly about the whole R&D system to the MIC, pointing out the inefficiency of ETRI. As a result, the new organisation was established to manage the R&D. We changed the manner of the development in 1994, which, I believe, was a critical turning point. Since that time, *each participant has been encouraged to develop practical products on the basis of competition*. And ETRI only continued to play a role in establishing a technology standard. (Hong, Soon-Ho, 15 June 1996; emphasis added)

---

[102] Saw, Jeong-Uk is a well known figure in Korean telecommunications. He used to be the leader of the organisation of TDX developments. He became President of Korea Mobile Telecom after it was privatised under the ownership of *Sunkyung* in 1994.

[103] See section 11.5.5.

It seems that the change from joint development into competitive development was actually driven by the Task Force as it announced that KMT would select one manufacturer rather than purchase equipment from all three participants. The critical reason for LG's declaring independence is found in the situation where competitive development was actually encouraged by the Task Force as the interview above indicates.

The Task Force organised the development effectively, by providing user requirements to give a direction to the development, and by driving the development and systems testing, etc. A member of staff in KMT indicates the role of KMT as follows:

> If we look at the development process, I do not think we could have completed the development under ETRI's initiative. It was the right decision to give the initiative to a carrier who would eventually purchase the system. The Task Force was completely comprised of staff from KMT, apart from the leader, Saw, Jeong-Uk. KMT provided specs with 600-700 user requirements. In other words, it identified those problems that the manufacturers had to solve, and it provided the testing environment by assessing deadlines for submission. I appreciate the role of ETRI in the process of selecting the CDMA technology. I wonder whether KMT could have picked up the seed of CDMA. At the time when ETRI started research on CDMA in 1989, KMT was busy with installing AMPS to keep up with the market demand rather than preparing new technologies for the future. But it is right that in the implementation stage, the carrier leads the development. (Lee, Ju-Hyung, 17 June 1996a)

Before joint development actually broke down, each of the manufacturers had pursued their own systems. The individually-based contracts with Qualcomm embraced the risk of waste of investment and of incompatibility between systems proposed by each manufacturer. Since 1994 when joint development system broke down, incompatibility problems became real. Although KMT drove the competitive development, KMT prefers to have a unified system interface. The reason why KMT drove the competitive development seems to have been to maintain the speed of development so as to keep up the development schedule. An interview with a member of staff in KMT shows what KMT actually wanted as a carrier:

> For us, it is better to have a unified interface between the MSC and the BTS as the two operate in an integrated system. If we look at the hierarchy of the system, it is impossible to connect, for example, the MSC from LG to the BSC from *Samsung*. The system under a specific switching system is self-contained. The interface, for example, between the MSC in Seoul and the MSC in Pusan is not as significant as the interface between the MSC and the BTS. We can handle it. That's why we chose *Samsung* and *Hyundai* for the system installation in Daegu/ Kwangju and Pusan/ Kyungnam respectively in the second procurement process. But because we were being chased by a time schedule, we could not help driving the competitive development. (Chang, Choon-Sik, 17 June 1996b)

On the one hand, the Task Force drove the development by changing the development scheme from joint development into competitive development. On the other, it appears that technological task in terms of the technological contents was realigned. ETRI changed its internal organisation of the development by prioritising the movement of staff to the switching system section from the wireless technology section once the Task Force was launched. An interview indicates:

> At that time (after the Task Force launched), a considerable number of staff changed in ETRI. The new members of the development teams in ETRI had good relationships with us, partly because the new members of staff had experience of developing TDX systems with us. They were staff who knew how to co-operate with private companies. The previous staff did not know the co-operative mechanisms and most of them were from the division of wireless technology rather than from the division of switching systems. (Hong, Soon-Ho, 15 June 1996)

This interview describes the improved relationship with ETRI after ETRI changed its internal organisation. The reason why ETRI changed its internal organisation can be interpreted as a reflection of ETRI's efforts to establish better relationships with manufacturers, by deploying expertise in TDX development. In addition, the development stage had actually moved from a focus on RF technology to switching technology over and above the issue of the relationship between ETRI and the manufacturers. However, I suspect the reason why ETRI changed the internal organisation of its CDMA development team can be found in the fact that the direction of CDMA development had turned from the aim of developing RF technology into concentrating on developing the switching system, as the time schedule was tight. The CDMA system still relies on Qualcomm's RF technology although people claim that TDX technology is critical. In fact, it is a very critical point if it actually happened. Unfortunately, I did not directly ask this question as I did not realise this point was critical when I was in the field. I simply thought the stage of development had changed, and ETRI made an effort to co-operate. I can now only assume this probably happened with correlating other factors. An interview I conducted seems to support my interpretation:

> Qualcomm always argued our time schedule was unrealistic. *We had to choose key technology to identify the technology we already had and the technology we needed to get from Qualcomm.* We completed the system by integrating our own switching technology with the proven technology through Qualcomm's experiment.
> (Lee, Hun, 13 June 1996; emphasis added)

The aim of development can change depending on what the players see as the critical elements of the system development. The aim can be modified in the process of development. The problem is that the interviews I have only show results. These results can be justified in a post-hoc way since people may claim that the outcomes were intended from the beginning. This can be understood in terms of the political factor surrounding the development. An interviewee implies what might have happened if the development had not succeeded.

> In the case of the USA, their situation was not as urgent as ours because they could keep up with the market demand with their analogue system for some time anyway. In our case, we were in a sort of 'live or die' situation where many people had to take responsibility for political decision as well as market pressures. (Lee, Hun, 13 June 1996)

However, the only valid data we have is that the technology initiative of the development changed from RF technology to switching technology with the launch of the Task Force. It is not clear whether that simply reflects the stage of development, or whether the Task Force modified the aims of development.

The collapse of the joint development scheme was driven by the Task Force. However, it actually reflects the changing relationship between ETRI and the manufacturers. We have seen that ETRI was losing the power to control the development. An interview shows the frustration manufacturers felt in co-operating with ETRI:

> They worked for themselves rather than trying to make full use of the capability of manufacturing companies. They regarded the other participants simply as assembly centres, which created difficulties in co-operation. They should have appreciated the capability of private participants, which already had experience of switching systems. They even encouraged assembly competition between private companies, which was really ridiculous. (Hong, Soon-Ho, 15 June 1996)

The comment above was actually made to criticise ETRI's inefficiency in organising the development, but it still shows what the manufacturers felt about the joint development scheme with ETRI. The power of control could only be sustained as long as ETRI's technological capability was superior enough. An interview with a responsible member of staff in *Hyundai* shows the point:

> Until early 1994, we can say it was joint development. After completing high level design before getting into implementing, the joint research actually broke down. If ETRI had had superior technology capability to the private companies, such that the

> private companies had had to rely upon ETRI for the original technology, it would not have been possible to dismantle the joint development scheme. In the process of development, ETRI relied on the other participants for some of the technology. If the technology upon which ETRI relied proved critical to the whole system, then ETRI cannot control the development when a participant walks out. What happens then is that the other participants who expect ETRI to organise how the technology is shared out with the other manufacturers are then helpless, as ETRI cannot deliver that technology. In fact, that kind of situation happened to us when *Samsung* walked out (August 1994). Well, at that time, ETRI and *Samsung* were in charge of the main parts, whereas *Hyundai* did not play a vital role in developing systems. *Samsung* gradually showed its frustrations about the joint development, meaning that it was able to manage the remaining development without ETRI's co-operation. We were just helpless at that time as ETRI was not in a position to get the technology from *Samsung* nor to let us share it. It was more disastrous for us when *Samsung* walked out than when LG did. At that time, *Samsung* was in charge of developing the operating system. You see, *Samsung* saw that the technology would have been transferred to *Hyundai*, which is its competitor, once *Samsung* gives it to ETRI. (Kim, Chul-Kyu, 14 June 1996)

It seems that the changing status of ETRI as the result of manufacturers' technological maturity caused the competitive development. The organisational change which devolved the initiative to KMT could accommodate the changing relationship between ETRI and the manufacturers. The change of development strategy embodies the limitations of ETRI's initiative over the mature manufacturers. The interview continues:

> Compared with the early 1980s, the status of private companies has changed in the process of developing the TDX series and of selling the system, and they have also grown up in the domestic economy at large. We were elementary school students in the 1980s, and are now grown up to university students. We have got to change our status in our relationship with ETRI. We do not want to rely upon ETRI any more. Rather, we have our own plans. In the past, we thought we would die if we do not join the development. But now, we think we can do it on our own. In the joint development, we were supposed to enter into a division of labour and then synthesise our efforts in the end. We did it before. This time, although we also entered into a division of labour, it was agreed that all companies could develop each other's parts as well if they wished to. In the end, it turned out that each company developed its own system. (Kim, Chul-Kyu, 14 June 1996)

In sum, the role of ETRI was crucial in the pre-commercial stage of the development. ETRI lost the power to control the development as it moved to the switching system stage. In addition, mature manufacturers no longer relied on ETRI for technology transfer as much. The organisational change in the process of development reflects this phenomenon. First, the actual initiative moved to KMT, the carrier, with the role of directly assessing user requirements; second, the newly-established Task Force drove competitive development; and third, it possibly realigned the technological tasks. The changing process of the development reflects the power relations among the players.

The next section shows the manufacturers' roles and the features of competitive development in more detail.

11.5.5 Competition between Manufacturers

> The manufacturers were obsessed with competition, continuously differentiating their own system by choosing between critical points which occurred over the process of development. In the case of LG, it succeeded in developing its own system, which all had pursued, a bit earlier than the others. Although we could have lost some benefits of joint development in terms of efficiency, the results of competition turned out to be not so bad. (Lee, Hun, 13 June 1996)

The interviewee in ETRI finds the origin of competitive development in the nature of manufacturers which are already competitors in many areas of manufacturing in Korea (see section 7.3).

To begin with *Hyundai,* let us look at each company's position[104] in the development process. *Hyundai* was behind in the process, as it was its first time to develop and produce such a large scale of system. *Hyundai* has relatively weak technology capability compared with *Samsung* and LG, which have more than 10 years experience of developing and producing switching systems. The interviewees agreed that *Hyundai* benefited most from the joint development by learning and accumulating experience (Source: Hong, Soon-Ho, 15 June, 1996; Kim, Chul-Kyu, 14 June 1996; Lee, Hun, 13 June 1996). The first procurement selection was held in May 1995, but *Hyundai* completed system development in September 1995, and was the last to finish. It eventually won a procurement contract with KMT in October 1995.[105]

---

[104]The interviews I have with the manufacturers do not cover LG's position directly from staff in LG. So, we can only see LG's position through the other participants' views. I was not able to access a responsible member of staff in LG, because the person I tried to interview was not willing to respond because he was busy. The route through which I approached responsible members of staff was a member of staff in ETRI, who gave me information on the proper contact points in each manufacturer and allowed me to use his name when I contacted those members of staff. In the case of those members of staff in *Hyundai* and *Samsung*, they seemed to have a personal relationship with staff in ETRI, which was possibly accumulated in the process of joint development. The member of staff in LG, I suspect, did not care about the personal relationships with staff in ETRI, as LG turned out to be the first to run away from the joint development, by declaring independence from ETRI. It seems to me that the potential interviewee's response also reflects the relationship with ETRI. In Korean culture, people do not normally refuse a request if it comes from somebody whom they have personal relationship with, as long as the request is reasonable. When I met a member of staff in *Hyundai*, he said, "I came here because of Mr. Kim, you know."

[105]*Hyundai* is now constructing systems in Pusan and Ulsan under KMT's second procurement process.

My interviewee in *Hyundai* was the leader of the development team and was head-hunted from *Daewoo* where he had participated in developing the TDX series. His move to *Hyundai* was part of *Hyundai*'s efforts to build up their own capability in switching systems.[106]

> I have developed switching systems for 19 years. *Hyundai* has been involved in the CDMA development for three years, but I have only worked for *Hyundai* since May 1994. Because *Hyundai* needed experts in switching systems ... I did a good deal of human networking in ETRI since I got involved in TDX development. The reason why *Hyundai* scouted me, I believe, is because I have got a good relationship with staff in ETRI.[107] I think the private channel I have worked very well for *Hyundai*. It's actually a peculiar Korean condition, isn't it? (Kim, Chul-Kyu, 14 June 1996)

Because of the lack of technology capability in switching systems, *Hyundai* relied on the joint development scheme which also made *Hyundai* also rely on ETRI. As we saw in an earlier section, the joint development scheme could only have continued through recognising ETRI's power. The interviewee in *Hyundai* admitted:

> In fact, *Hyundai* had to rely on the joint development with ETRI. It was the end of 1995 when official joint development ended. Until then only *Hyundai* remained joint with ETRI. Unlike LG or *Samsung*, which had their own technology capability in developing the system, *Hyundai* did not have any experience in developing switching systems, apart from simple assembly and selling EPABX[108] in a link with Hughes America. *Hyundai* learned the technology and received the technology per se, whereas *Samsung* and LG had their own adjusted model[109] of TDX-10. In fact, it is *Hyundai* which benefited from the joint development. (Kim, Chul-Kyu, 14 June 1996)

The technological differences among the competitors are: LG's BSC function is integrated into a switching system (MSC), whereas the system *Samsung* and *Hyundai* developed has separated the BSC function from the MSC. The differences between *Samsung* and *Hyundai* lie in the design and structure of the RF process (BTS) and the BSC. On the one hand, *Hyundai* adapted an operating system function which it had developed on its own into the system operating in the CDMA system. On the other, *Hyundai* admitted that it had made

[106] The interviewee explained the situation: "the technology *Hyundai* got from ETRI was not enough, *Hyundai* had to develop its own capability, so it recruited over 40 members of staff who had experience of switching systems in the middle of development. *Daewoo* and *Hanwha* Electronics, which produce TDX-10, but which were not selected to develop the CDMA system, became targeted as resource for new members of staff. Almost 150 members of staff are devoting themselves to the switching system development at the moment" (Kim, Chul-Kyu, 14 June 1996).

[107] In Korean culture, people wouldn't say "Because I am so smart, the company scouted me." The comment the interviewee made indicates that the relationship with ETRI was important for *Hyundai* rather than that he was scouted only because he enjoys good relationships with staff in ETRI.

[108] A private exchange system: it covers 1000 subscribers

[109] *Samsung*: SDX 100; LG: Starex

incredible efforts to get *Samsung*'s source code through ETRI (Source: Kim, Chul-Kyu, 14 June 1996).

Hyundai's position implies that technological reliance was crucial for the joint development.

Moving on now to look at *Samsung*'s position, it is worth mentioning a brief personal impression. The interviewee in *Samsung* was in charge of the internal development team. He wondered to what extent he could possibly expose the process to me, because the development process is like a battleground where all the interests of participants cross and it embraces politics, meaning that the people involved take responsibility for any faults found. Even though he admitted that he was careful about exposing very sensitive factors, he became a good source for looking at manufacturers' positions as well as for sketching the whole picture of the process.

First, he responded to the question of evaluation with respect to *Samsung*'s role in the development process as follows:

> I think that *Samsung* contributed to providing system solutions in the whole process of the CDMA development, with our existing technology capability in the general telecommunications area. I think ETRI achieved the development jointly with *Samsung*. I was, actually, side-stepped from the development process in 1993.[110] We had the first communication trial for the CDMA system in our building, which was criticised by ETRI. (Hong, Soon-Ho, 15 June 1996)

The interviewee claimed the *Samsung* system was the best, in describing the procurement process, which actually opposes the view presented by the other organisation.[111] But I do not think it is my job to judge which one is the best. What matters is how they see themselves and others. He continues:

> Then, we participated in the testing of the commercial system organised by KMT. Even during the testing stage of commercialisation, we were always ahead. We were selected as an equipment vendor for *Shinsegi*, which was trying to select even amongst foreign manufacturers. No obligation, actually, but there was a sort of pressure to procure domestic equipment from the Government, I suppose. KMT was in a sort of unrequited love with *Samsung*. We, however, saw more positive market prospects in *Shinsegi* because it is a new carrier and will procure the entire system, based on digitalisation. We selected *Shinsegi* rather than they selecting us. After

[110] The reason why *Samsung* stepped aside in 1993 is explained in section 11.5.4, in terms of the frustration *Samsung* felt in the joint development process.
[111] See section 11.5.6.

> that, KMT selected LG, beginning to underestimate our system in order to justify the situation where they had to select LG. We chose to cease testing under KMT in the middle of the testing procedures. (Hong, Soon-Ho, 15 June 1996)

In terms of the technological capability of the switching systems of the domestic manufacturers, *Samsung* claims that it has the best capability.

> In the process of developing the TDX series, we contributed most with the technology capability we had already got from Alcatel. In the case of LG, it had a technology transfer contract with AT&T, which is notorious for being reluctant to transfer technology. In fact, the technology capability of the switching system of *Samsung* is the highest. We have always been the first runner since the early development of TDX. (Hong, Soon-Ho, 15 June 1996)

LG has the longest history in producing switching systems, introducing EMD (Electro-Mechanical Division) mode from Siemens. *Dongyang* provided a Strowger switching system since the middle of 1960s. *Samsung* entered the area of switching systems with its private switching system in 1977. In 1980, it had a technology transfer contract with Alcatel. At that time, the company was Korea Electronics Telecommunications Co., which was purchased by *Samsung*, when it was privatised in 1979. *Samsung* has 19 years experience in developing switching systems including participating in the joint development for TDX (Source: Hong, Soon-Ho, 15 June 1996).

Why did *Samsung* not leave the joint development scheme early, like LG? Why should it remain until August 1994? The interviewee was a bit embarrassed, and pointed to the lack of some key technology capability within *Samsung*. However, he did not say exactly which technology was the one *Samsung* wanted to get from ETRI. He said that even if he had explained, I would not have been able to understand because the contents were too technical. I am not sure whether it was really because I am not an engineer and so, he thinks, can never understand technological detail, or because he did not want to expose the detail.

> Well, we actually had some problems with a certain technology solution, which we wanted to get from ETRI, and which LG had already got. That's why LG walked out first. We have experience in developing analogue systems and in providing paging systems in the domestic market, which enabled us to have a relatively strong technology capability in the area of RF. We were thinking that we could remain competitive while remaining in joint development with ETRI, because we could differentiate our system from the others with the strong RF technology capability. (Hong, Soon-Ho, 15 June 1996)

Samsung tried to enter into another contract with Qualcomm for getting the technology it lacked, when competitive development began. The interviewee continued:

> That's why we tried to connect with Qualcomm. But we did not make it with Qualcomm, as we chose to remain with ETRI. At that time,[112] we considered our own joint development with Qualcomm, apart from the existing contract, by suggesting that Qualcomm and *Samsung* make a product and launch it world-wide by marketing it together. But the contractual conditions Qualcomm suggested were not fair enough. (Hong, Soon-Ho, 15 June 1996)

Samsung, however, had to endure a disadvantage in the formal joint research scheme, since it had to expose the contents of development. Consequently, *Samsung* had to focus on the differentiation of its system:

> We were not able to access the system structure of LG, while ours was relatively easily exposed to LG. Then, how to achieve a superiority of development over LG became a critical issue. Firstly, we focused on the timing of development. Second, we made full use of our strong position in RF, in other words, in the area of the BTS. Third, we had our own vocoder (voice coding) technology, whereas the others had to import it from foreign markets. Fourth, we took SDX 100 as basis of the MSC rather than TDX.[113] (Hong, Soon-Ho, 15 June 1996)

Samsung was against the selection of CDMA from the beginning and it has accumulated capability in TDMA technology. There was an episode which occurred in 1994: *Samsung* Electronics, one of the most capable companies[114] in Korea had withdrawn from the joint R&D national strategic technology development scheme with its evaluation of 'unqualified performance', made by ETRI. *Samsung* was involved in developing a signal processing ASIC for a digital mobile communication system, which was being undertaken in a different development scheme from the CDMA system development; and that is the element Korean manufacturers are importing from Qualcomm at the moment. *Samsung* claimed that it has concentrated on the development of ASIC for TDMA on its own (Korea Economy News, 14 March 1994).

---

[112] Between the time when competitive development actually began with the launch of the Task Force launched and the time when *Samsung* chose to remain joint with ETRI.

[113] It sounds as if *Samsung*'s system is based on different switching system from TDX. But, SDX 100 is a kind of applied system of TDX for the CDMA system. (Source: Kim, Chul-Kyu, 14 June 1996).

[114] The superior capability of *Samsung* electronics has been proven by its having highest number of registration of patents and utility models in Korea since 1990. For example, in 1993, *Samsung* Electronics had 947 unit of patents, whereas LG had 464 and Toshiba in Japan had 531 (*Chung-ang* Economy News, 7 April 1994).

It seems that, although *Samsung* participated in joint development of CDMA in the equipment area, it sees more feasible prospects in TDMA with respect to ASIC production and to market value. *Samsung* also appears not to cling to the national strategic technology development scheme in terms of funding and guaranteed procurement any more. It seems confident of its own capability of technology development and of its world-wide market prospects.

Concluding *Samsung*'s position in the development process, *Samsung* was frustrated by its joint development with ETRI, a frustration caused by its confidence in its own technology capability. With that capability, *Samsung* tried to use the joint development scheme to improve its capability in specific areas integrated in the CDMA system development, rather than relying entirely upon the joint development scheme. The case of *Samsung*'s position shows how domestic manufacturers are becoming independent from the Government, specifically from ETRI, as their own capability matures.

The next section examines the position of the carriers, KMT and *Shinsegi,* which are the purchasers of the system.

11.5.6 The Positions of The Carriers: KMT/ *Shinsegi*

The positions of the carriers are found in the development process as well as the procurement process. As described in section 11.5.4, KMT got deeply involved in the development process, in the form of the Task Force. To avoid repeating KMT's initiative in the development process, I begin with the procurement process with respect to the two carriers.

KMT started testing procedures in late 1994. *Samsung* produced a commercial model first, *Hyundai* followed and LG was last. At that time, *Samsung* walked out of the testing procedure in KMT to concentrate on other user requirements, as it had been chosen by *Shinsegi.* This happened for the first time in the history of the technology development, and was caused by the presence of more than one purchaser. Before, when manufacturers took part in a joint development, there was only one user requirement (Source: Lee, Hun, 13 June 1996).

In terms of the performance of the systems each manufacturer produced, there do not seem to be any significant discrepancies. A member of staff in KMT evaluated each system as follows:

> For KMT, it is very important to have a roaming function.[115] LG's system is advanced in the area of roaming. And, also only LG's system supports a dual system for analogue and digital. *Samsung* has experience in producing AMPS, so it is advanced in the area of RF technology as well as switching technology. At the moment, our evaluation is that *Samsung*'s BTS is superior. I believe, in the near future, that the technological capability of *Samsung* and *Hyundai* will follow the roaming function of LG. (Chang, Yoon-Sik, 17 June 1996b)

In looking at carriers' positions, the interviews with staff in *Shinsegi* are more realistic in that *Shinsegi* is supposed to provide services only through a digital system. A member of staff in *Shinsegi* offered a rather different view on the procurement process: "As far as I know, KMT favoured LG and gave it lots of information, which made *Samsung* upset and walk out" (Saw, Dong-Jin, 21 June 1996b). The other member of staff in *Shinsegi* added:

> After we contracted *Samsung*, there was no reason to continue the test in KMT base for them. Above all, *Samsung* could not afford the testing procedures with two companies because of the limitations of manpower. (Saw, Jung-Won, 21 June 1996a)

The interviewee responded to the question as to why *Samsung* was chosen by *Shinsegi* as follows:

> I don't think there are big differences in terms of superiority of system between *Samsung* and LG. I am not in the position to say why *Samsung* was chosen. I don't know much about it. But I suspect that there must be some politics behind. The relationship between *Samsung* and the ownership of *Shinsegi, Pohang* Steel Co. and *Kolon* can be a more important factor than the technological performance, I suppose. You know that. We argued a lot with *Samsung*, who just said the system works very well as an equipment vendor. But we did not see that the system actually worked! Still *Samsung* and we do not get along very well. (Saw, Jung-Won, 21 June 1996a)

Was it only favouritism which guided the selection of the equipment vendor? Anyway, neither staff from KMT nor *Shinsegi* seem to care about why particular vendors are chosen.

---

[115] This is the function of supporting communications when a subscriber moves to an other district where a different system is installed, for example, between a digital system and an analogue system, or between LG's digital system in Seoul and *Hyundai*'s digital system in Pusan.

Technological superiority can be judged depending on carriers' requirements. The systems installed do not seem perfect. As the manufacturers admit, the systems are still at the stage of improvement and refinement even after installation. My concern was not in the question of which one is better per se. Rather, I wanted to find out what the carriers wanted from the system through the procurement process. Through the question, as the interviewee above shows, frustration stems from the fact that the newly developed CDMA system was not performing very well, rather than from *Samsung*'s product per se. Carriers, *Shinsegi* especially, were not satisfied with the system.

The main problem *Shinsegi* has in using the newly developed CDMA system is that it takes risks in service provision. The interviewee complained the situation where *Shinsegi* must use a system which has not been proven commercially, taking all the risks:

> CDMA has not been proven. What are the criteria to prove the CDMA technology? The rate of traffic completion can be a criterion. We think the rate should be over 97%, but currently the CDMA system only has 90%. I am not talking about the fact that the new system does not have 20 times more capacity than the analogue system as was claimed. Even with 3-5 times more capacity than analogue, with which the present system is performing, now we only have 20,000 subscribers, which is unlikely to create a big disaster, but we do not know what would happen once the subscribers reached over 100,000. In the case of the USA, even for the PCS system they have seven types of standard, so that the most competitive one would survive in the market. *Shinsegi* is like a test bed of the new system which the Government has driven to develop, and which is not safe enough. It's really risky, you know. (Saw, Dong-Jin, 21 June 1996b)

One interviewee complained that the installation of the present system is not reasonable in terms of safety:

> Motorola says it is sure CDMA is not safe yet. Telecommunications technology is a sort of technology of 'trial and error.' Nobody can predict it without implementing it in practice. It took 5-6 years for analogue technology to settle down. Even for the new digital technology, how long will it take? At least, we need 2 or 3 years to settle the new technology down. In fact, you know, our dealers got complaints quite a few times from customers who bought the digital terminal equipment. But I think this situation is really normal to some extent. Motorola claims that it was able to produce the same level of product in 1992 which domestic manufacturers are producing now. In the case of the USA, it has a well advanced analogue system, so that market conditions do not force carriers to desperately seek the new digital system. And, also, the customers in the USA are not as generous as the customers in Korea, I believe.[116] Motorola thought that the CDMA system had not to be installed, since the system was not perfect enough to be launched in the market. (Saw, Jung-Won, 21 June 1996a)

[116] The implication is that Korean customers could be persuaded by the notion of indigenous technology. Even if the quality is not good, people are likely to remain loyal to the system for a while.

In the process of service provision, *Shinsegi* complained that it also suffered disadvantages in using unrefined terminal equipment. They suggested that I look at and use the terminal. It was heavier and looked rather tough, as compared with analogue terminal equipment. The first commercial model of digital terminal equipment was not good enough in terms of design, size and weight. The digital terminal is 50g heavier than the analogue terminal, whose size has been reduced over its 10 year history (Source: Saw, Dong-Jin, 21 June 1996b).

Under the circumstances, *Shinsegi* was reportedly considering procuring CDMA equipment from foreign markets, raising the issues of safety and compatibility between the systems of domestic products in November 1994, when the development stage had reached the testing procedures. *Shinsegi* requested procurement proposals from AT&T, Motorola and Northern Telecom as well as from domestic manufacturers. The foreign manufacturers reportedly proposed half the price of the domestic product (Korea Economy News, 10 March 1994; *Geil* Economy News, 29 November 1994). The interviewee explained the background as follows:

> At least, we got to compare the technology and the price, which is different in each company's case. For example, the system *Samsung* developed does not realise the roaming function in RF. When we actually chose the domestic manufacturer, it helped in a way as it provided a standard to choose from. In fact, although we wanted to buy the foreign system, well, it was not possible anyway.[117] We were faced with a lot of criticism. (Saw, Jung-Won, 21 June 1996a)

Shinsegi plans to purchase foreign equipment after installation, and this has became possible in the open procurement market environment.

> Under open procurement market circumstances, the carrier will not be able to accept guaranteed procurement, which forces the carrier to wait for the finishing system development. Standardisation, like CDMA, is one of the tools for preventing carriers from buying foreign systems.[118] What countries have adopted CDMA so far? Only Korea. In the future, telecommunications will be globalised. Then, the unique standards like CDMA, which are not compatible with world-wide standards become quite problematic. Anyway, we are trying to purchase some foreign equipment for some parts of the local network. These days, government policy is not as stubborn as before because the Government is also burdened in launching the

[117] When *Shinsegi* was granted the licence of second mobile communications carrier, it declared that it would use domestic equipment in its proposal.

[118] Korea made a statement that the standard for service provision can be regulated according to domestic technology standards in 'offer lists' for NGBT. However, there was pessimism that the effort to protect domestic manufacturers will not work under the rigid pressure of open markets (*Hangiure*, 12 December 1995). See detail in section 9.3.1.

digital system successfully. And also, because of Korea - US talks, the Government is not supposed to intervene in the procurement practices of private companies. Some stock-holders of *Shinsegi* are foreign companies such as Air Touch, Southwestern Bell and even Qualcomm. We cannot rely on only one vendor for our system. Once we expand our system, it is difficult to keep up the quantity of system procurement for only *Samsung* anyway. (Saw, Jung-Won, 21 June 1996a)

There was one more sensational moment in Korean telecommunications in 1995: *Shinsegi* appealed to the MIC to allow it to provide services using an analogue system despite the fact that *Shinsegi* was granted a licence as second mobile carrier under the condition that it deploy digital service provision. The MIC countered *Shinsegi*, saying that it would cancel the licence if *Shinsegi* insisted on providing services with the analogue system. *Shinsegi* failed to convince the MIC and it started service provision in April 1996, postponed from January 1996. I managed to find out the background from my two interviewees in *Shinsegi*, and the main reason of the appeal was that, again, *Shinsegi* did not trust the CDMA system.

> We complained a lot on the basis of the foreign cases. And, last year, nobody was sure whether CDMA would be actually developed. So, we argued that we would start service provision with an analogue system and adopt the CDMA system once the technology had settled. We were really panicking, you know, that we should adopt an unproved system. I know we should contribute to reinforcing national competitiveness. That's nice. We do not deny it. We just suggested that we should accept reality. We would not be able to just wait until the new system would be ready. We wanted to provide an analogue service at least in Seoul, where there would be very heavy traffic. Anyway, our suggestion did not work out. (Saw, Jung-Won, 21 June 1996a)

The MIC was not persuaded by *Shinsegi* as the attempt to provide service by analogue could damage the whole development structure in terms of procurement, funding and, above all, political responsibility.

> I think that the situation is rather political. The Government has driven the development and implementation. Who would be responsible for the budget of 50 thousand million Won which comes from taxes, if the carrier does not implement the system? No way. (Saw, Dong-Jin, 21 June 1996b)

Shinsegi, however, is now allowed to deploy 'roaming' by interconnecting with KMT's analogue system, which is, I think, a rather critical policy decision which provides a relatively safe environment for *Shinsegi*. The interview continued:

> Although our argument that we should adopt an analogue system was not approved, the MIC granted 'roaming' for *Shinsegi* in the form of interconnection with KMT, which has the nation-wide analogue network. It would take some time for *Shinsegi* to have the nation-wide network. Even in 1998, when *Shinsegi* is expected to cover the nation with its own network, the network will only cover the areas of the several

big cities. So, for a year, we have recently been allowed to connect our network with KMT. Now, we are in negotiation with KMT for the interconnection. Because our system is not safe enough, the Government has offered an alternative. (Saw, Jung-Won, 21 June 1996a)

Interconnection with KMT is very significant for *Shinsegi*, not only because *Shinsegi* will be able to rely on the analogue system if any problems occur in the digital system but, also, because *Shinsegi* can now attract those analogue subscribers to KMT with its dual mode terminal. Through the interview below, which described the disadvantages of digital service provision, we can easily extract this significant factor for competition.

> Customers who want to get services through digital means need to buy new terminals. Then, the price of analogue terminals should go down. If we were allowed to provide services with an analogue system, customers in KMT can easily move to *Shinsegi* without bothering to buy new terminal equipment. (Saw, Dong-Jin, 21 June 1996b)

Unlike *Shinsegi*, KMT did not complain about the CDMA system. It seems to me that it is because KMT sees itself as a participant in the development process, which is true. The interviewee in KMT seemed rather positive about the newly developed CDMA system, as we see in the comment as follows:

> I do not understand why people still do not admit the presence of the CDMA system. It has been successfully developed and installed. Now[119], digital subscriptions are reaching 100,000. Taking into account the fact that digital is being commercialised for the first time, that seems all right. (Lee, Ju-Hyung, 17 June 1996a)

The rather calm response of KMT compared with *Shinsegi*, however, does not seem to stem only from the fact that KMT actually participated in the development process. If we recall *Shinsegi*'s frustration, KMT is in relatively relaxed position with respect to risk. KMT has already got a nation-wide analogue network which possibly complements the CDMA system's risk with the function of 'roaming' between analogue and digital. We can also recall KMT's first technological requirement for the CDMA system in the procurement process, i.e. the 'roaming' function. In sum, KMT has relatively more time[120] and facilities to endure the possible risks until the system settles down.

---

[119] Late June 1996.

[120] Given that digitalisation had been proposed as a technological alternative to expand the capacity of frequency, the task of keeping up the demand with an analogue system until the digital system in mobile communications was commercially available still remained. In the case of the USA, new technology in mobile communications such as Micro Cell, Sector etc. made it possible for the service providers to

In sum, the carriers who installed the CDMA system were concerned about the safety of the newly developed system. In the case of *Shinsegi*, it sought a way to reduce the risk by attempting to purchase a foreign system and to provide services by analogue. In the case of KMT, it reduced the risk with its roaming function. The technological safety was still problematic in the commercialising stage, as the system did not have enough time to fully refine its functionality. The mechanism for this installation resided in the Government initiative over development. The Government assessed the compulsory procurement for domestic production. Public sentiment supports indigenous technology, and can endure the disadvantage of the risks.

11.6 The Presence of Universal Service in CDMA

In the CDMA development, concerns as to how universal service is interpreted among players were not directly investigated. Discourses in the developmental process mainly focused on national competitiveness. If there are concerns as to public interests, the issues have already moved to the concern of 'customers' in terms of prices and usage. An interviewee in *Shinsegi* pointed out a tension between national competitiveness and carriers' taking a risk in terms of serving customers' interests in implementing CDMA system:

> The Government only sees the matter of indigenous technology. But, because of being first to develop and commercialise the system in the world, we take the risk. Protectionism has been deployed for manufacturers, and I understand that CDMA was also pursued as a national standard in the context of reinforcing national competitiveness. But, in our position, it is better to choose a system which is cheap and reliable, whatever the system is. Even for the customer, the low price of terminal equipment helps to spread the service easily, as well as the low price of system equipment, which reduce the tariff for customers. (Saw, Jung-Won, 21 June 1996a)

It was in fact problematic to implement digital service in a situation where CDMA system was still in the stage of being refined. The system was implemented and the service began to be provided to keep up the digital service provision scheduled before. In this circumstance, 'customers' were still encouraged to convert their subscription from analogue

---

accommodate more subscribers with the same bandwidth of frequency. KMT had been raising the capacity to accommodate subscribers by using Micro Cell technology. By the end of 1995, the demand in Seoul, which was predicted to reach 0.6 million was claimed to be satisfied with the new technology in analogue before CDMA was installed (KMT, 1996).

service to digital service. Even if Korean customers remain loyal to the newly developed digital system in terms of public sentiment towards an indigenous technology, it does not seem fair to give them a burden of high price and unsettled technology. Even from the 'customers' point of view, implementation of CDMA system was problematic.

However, the point here is that, in mobile communications, discussions on public interests in telecommunications focused on customers' right rather than on the ubiquitous diffusion of telecommunications service in terms of a positive policy concern on universal service. It seems that policy makers assume that national competitiveness will eventually meet public interests in terms of a long-term economic prosperity through possessing its own technology.

Universal service representing public interests in telecommunications policy needs be defined towards social equity. It is a challenging situation for policy makers and the mobile communications industry to look at universal service concerns in deploying the digital service not from customers' point of view but from subscribers'. This is the case because mobile communications will be a future form of telecommunications service for people. The CDMA case implies how national competitiveness and business concerns could be in tension with public interests. This is a similar message to that of KII case in that public interests still need to be defined separately from the concern of national competitiveness, and the CDMA case shows a pointer as to how the application of extreme market principles could overlook public interests in the telecommunications services.

11.7 Summary

So far, we have looked at the process of CDMA development, reflecting the players' concerns and interests and examining the sociotechnical elements which are involved in the process.

The case of digital mobile communications system development shows a feature of technology development in the transition of telecommunications. The development of the

CDMA system has been undertaken under the heavy pressure of rapidly increasing demand and as a means of digitalising the system.

When Korea chose to develop the CDMA technology, it was not proven in terms of the market as well as of the technology itself, compared with TDMA technology. The issue of whether the CDMA technology was well chosen in terms of economic value and commercial prospects was highly disputed. In the selection process for the CDMA system, the decision-makers' concerns were based on the issue of possessing indigenous technology. The CDMA development was undertaken on the basis of joint development involving ETRI, domestic manufacturers and a foreign partner, Qualcomm. The development scheme changed from joint development into competitive development between manufacturers. The initiative for the development moved from ETRI to KMT. The capability of developing a CDMA switching system by using an indigenous switching system, TDX-10, is significant in building indigenous technology with the transferred technology from Qualcomm.

The process of developing CDMA technology shows a transition feature of the existing R&D system. The stable chain between ETRI (a government initiative) and manufacturers with the chain of superior technology capability, is being broken; and the chain between carrier and manufacturers with the link of guaranteed procurement is being broken by competitive procurement and by the presence of more than one operator. This chain will not endure in an open procurement market.

It seems that some significant implications can be extracted from the contents of this chapter and these are integrated into three themes: the issue of indigenous technology; the changing features of the R&D system; and the shifting balance of power between the Government and *chaebol*. These themes are dealt with in chapter 12.

PART IV

ANALYSIS AND CONCLUSIONS

Chapter 12: The Social Shaping of Telecommunications

12.1 Introduction

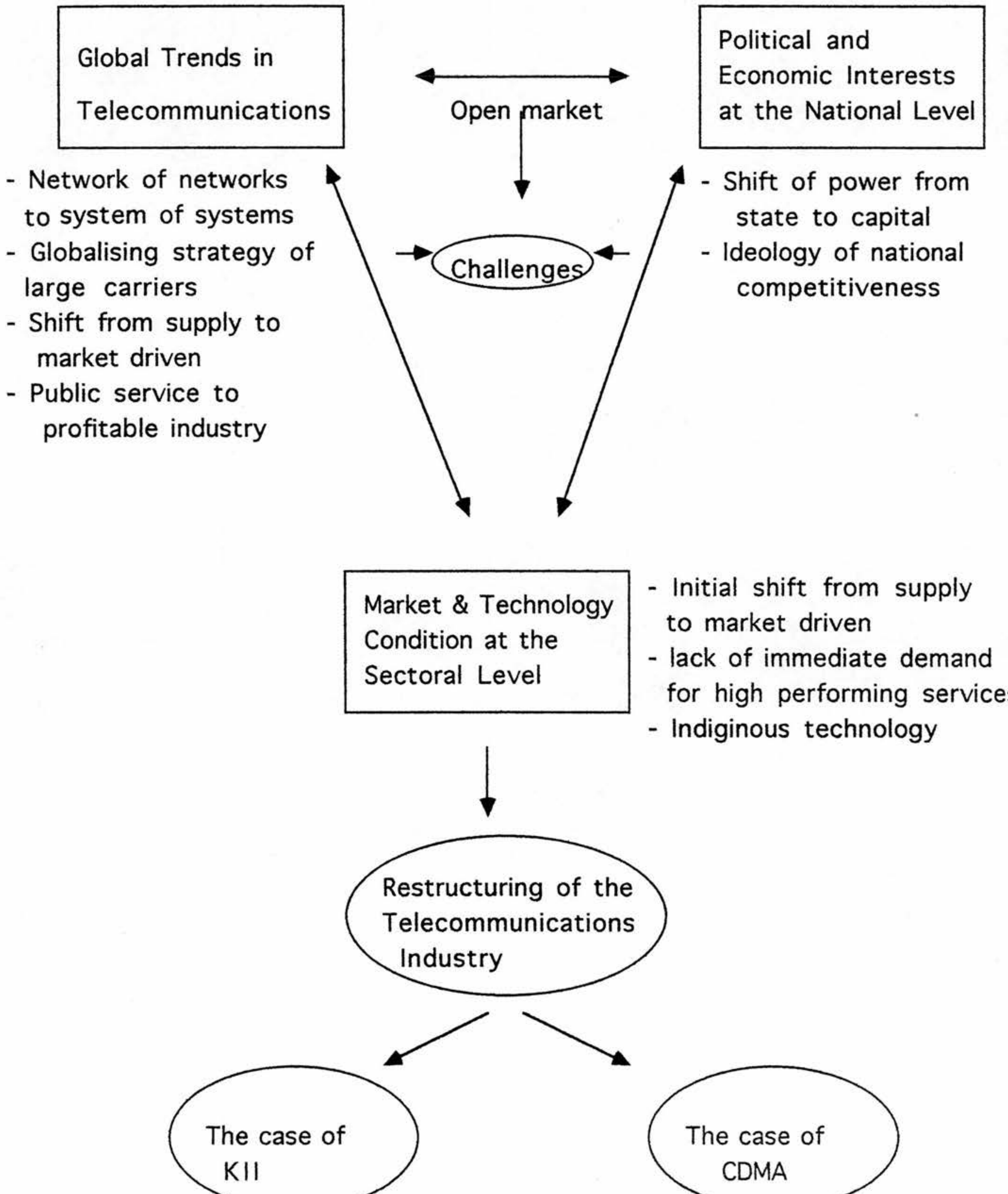
This thesis has posed two main questions: what are the sociotechnical determinants of the evolving telecommunications network in Korea and how do they operate?; What issues are raised by the restructuring of telecommunications in Korea? A subsidiary concern has been the place of universal service in the emerging new order of telecommunications in Korea. The analysis of the case studies is located in "the tensions between human agency and structural transformations that occur throughout the innovation process" (Mansell, 1996: 17). The shaping process has been illustrated in a way which contributes to understanding the interests of participants and the changes that occur as a result of these interests. In particular, I have examined how institutions are changing and how social forces are shaping them in this area, by considering the changing technology and the role of players in the process of designing and implementing two specific telecommunications development projects, KII and CDMA in Korea. The case studies reflect the interests of agencies such as the Government, Korea Telecom, newly emerging competitors in the private sector, and the wider community.

The Korea Information Infrastructure programme attempts to lay the basis for a vision of an information society in Korea into the future. The CDMA case could offer some pointers for KII development in the context of current changes in telecommunications. The mobile communications area is developing rapidly and is widely recognised as a profit-making area in telecommunications, whereas KII development still remains a vision established by virtue solely of a 'political push'. So, these cases are positioned in a situation where the nature of telecommunications is changing from a public service to a profit-making industry with strong participation by private capital. The telecommunications sector in Korea is now experiencing drastic change in both its policy framework and its industry structure. As the interests of capital constantly interacts with the interdependent relationship between the state and capital, this relationship is undergoing shifts in its power structure.

This thesis combines the 'social shaping of technology' tradition with the political economy of telecommunications (see sections 1.2.1 and 1.2.3). It has sought to illuminate the social shaping process of telecommunications development by unveiling the ideologies and interests of social agencies surrounding technology development and implementation. The preceding chapters were devoted to identifying the sociotechnical elements which operate to shape telecommunications in specific areas and in a specific social context. The sociotechnical elements are elaborated within a sociotechnical process which accommodates the 'social' and the 'technical' in an integrated way (see sections 1.2.1 and 1.2.2). At the same time, this thesis extends Mansell's contribution to unveiling the network design process within the strategic model towards building strategic alignments for public interests, by offering empirical evidence on how the industry is changing (see section 1.2.6). The concept of TNS (Telecommunications Network-based Services) guided the research so as to bridge institutions and technologies (see section 1.2.6). This evidence reflects the political and economic interests of players and brings the political and social conditions of society, in the context of NICs, into the shaping process. In the explanation of political economy, the relationship between state and capital which permeates the changes in the telecommunications industry was observed by revealing the power relations operating in the specific social context of Korea (see sections 1.2.3 and 1.2.4). I looked at the issues of the shift of relative power from state to capital, developmental concerns and globalisation. These issues are embodied in the characteristics of the sector. The cases of both KII and CDMA reflect these social contexts in different ways, determined by the extent to which the experiences are driven by the market.

Three levels of analytical abstraction were used to articulate social elements shaping the network evolution: global, national and sectoral (Figure 12-1). The interactions between these elements were integrated into an analysis of the restructuring of the telecommunications industry. This was set up as background for the analysis of the KII programme and the CDMA development. Global changes in telecommunications, the shift in power relations nationally, and changes in the telecommunications industry in Korea, were the main social and economic elements for understanding the shaping process of KII and CDMA.

Figure 12-1: Analytical Abstraction of The Social Shaping Elements



Each element is in transition. At the global level, the nature of the industry is in transition; at the national level, power relations are shifting; and at the sectoral level, the nature of demands in the telecommunications market is changing from basic voice service to advanced non-voice services. These transitions have their own dynamics though not in isolation from each other. It is crucial to acknowledge that these transitions actually intersect with each other; the case studies are an embodiment of these transitions. When we look at the technology development process, we see that the dynamics of social change and the dynamics of technology development have a never-ending interaction.

In this chapter, I identify the governance which shapes the processes of the two case studies throughout the analysis (see section 1.2.2). This governance is constituted by certain political economy elements which are identified in the remainder of this chapter. Within this framework, I articulate interrelations between factors constituting the sociotechnical process, and the rules and ideologies operating in the process. Thereafter, we can try to find a way to build up public interests in the change process in terms of public embeddedness, and this forms the subject of chapter 13. Both the KII (12.2) and CDMA (12.3) cases are dealt with separately in looking at governance using the sub-categories of political embeddedness, global embeddedness, and interaction with national power relations. The contents are then integrated into explaining the 'authoritarian mechanism' (12.4).

12.2 Governance in The Shaping of Network Evolution I: KII

It might be an understatement that the KII programme reflects the characteristics of social and economic development mechanisms in Korea, which have been planned and organised by an authoritarian political power (see section 7.2). In the USA, the information super-highway project (NII) has been developed in the process of strengthening national competitiveness and of being integrated into the private sector. The US private sector, in contrast to its Korean counterpart, is relatively autonomous. The 'authoritarian mechanism' underlies KII, but the shift of power relations between the state and capital is embedded in the process of realigning plans for KII's realisation. Also, KII presents a concrete aim for constructing a social infrastructure supported by the ideology of 'globalisation', which has become the dominant discourse in Korean society, emphasised by the present political power-holders particularly at the beginning of 1995 (see section 7.3.3). Political embeddedness represented in the concept of SOC (social overhead capital), the global embeddedness in the transition of telecommunications, and the reflection of internal power relations surrounding KII are outlined in this section.

12.2.1 Political Embeddedness in Network Infrastructure

The KII programme is aimed at constructing an information infrastructure within the terms of a vision of building an information society in Korea. KII is one of the national initiatives for network design for building an improved telecommunications infrastructure, following the US and Japan's commitment to construct an information super-highway (Harrison, 1993). The examination of NII in the USA in section 4.3 revealed that its development is actually less substantial in practice than is commonly acknowledged; KII is following a similar path. More significant are the changes in telecommunications it promotes and the realigning process of the programme. The concept of an 'information infrastructure' is highlighted politically as a blueprint for the future.

The national initiative of network design emerged from the characteristics of telecommunications as infrastructure (Schultz, 1994; Collings, 1994). The concept of SOC in KII represents the public sector emphasis on the telecommunications industry as infrastructure on the one hand, and the anticipated growth of the industry in the area of multimedia based on the inherent characteristics of externality (Antonelli, 1993) on the other. Developmental concerns are embedded in its sectoral characteristics reflecting its political vision and global influence.

The concept of SOC in the KII programme is commonly acknowledged (Harris, 1988; 1990). But the concept also embodies the political interests permeating economic concerns. After all, the current political power-holders need to project visible achievements to the public in the name of national competitiveness. The emphasis on telecommunications as 'infrastructure' in the process of building KII have reinforced the power of the MIC in a way which has integrated industrial policy beyond its original role as a regulatory body (see section 10.3.1).

Developmental concerns represented as SOC in telecommunications are intertwined with the changing nature of the industry. The telecommunications service area has become recognised as a highly profitable industry by the private sector. The dilemma the KII programme embraced is that telecommunications is moving towards telematics within which state's control is becoming less important, as the telecommunications infrastructure is now on a market-oriented path. In terms of deregulation and liberalisation, the state's control is loosening, whilst the emphasis on industrial policies for telecommunications is being reinforced (Scherer, 1994; Harris, 1988; Noam and Kramer, 1994). The national initiative of building a telecommunications infrastructure is being enacted in the dual context of a more emphasised industrial policy aspect to telecommunications and the catalyst of liberalisation.

The conflicting perspectives of SOC and an increasingly profitable industry in telecommunications have introduced different interests to, and even conflicts between, key social agencies such as the state, capital, the public, and Korea Telecom. The KII programme has been launched amidst a background where the present political power base is eager to establish a future blueprint for the public; where capital - whose interests find expression through large users of advanced telecommunications services, through the newly emerging potential telecommunications network and service providers and through producers for multimedia industries - needs to establish its place in the changing environment; and where Korea Telecom, as the existing monopolistic telecommunications network and service provider, wants to retain and augment its status.

While the Government justifies the KII programme on the grounds of developmental concerns, it still needs to encourage the private sector to invest in telecommunications overall. Industrial capital participates in network and service provisions and in equipment manufacturing. The private sector does not have any immediate interests in the KII programme, since the services available through the information super-highway are still supply-driven, whereas massive investment is required for subscriber loop construction. The private sector is not likely to devote itself to the programme initiated by the Government without visible returns. The introduction of competition in telecommunications is being propelled by the KII programme, providing the private sector with opportunities to expand both particular businesses and the general market. This is undermining Korea Telecom's initiatives in the public domain.

KII was launched in a situation where the governance of the industry is moving from a public to a market orientation, ironically, one which has the backing of strong government commitment. In the USA, the solution was clear: the Government liberalised the market, encouraging players in the industry to invest in infrastructure. That is, a market-oriented path was chosen. The industry in the USA is mature enough to compete with each other and the existing regulations were overwhelming the competitive environment, preventing industry from active investment. Also, in the USA, the superior condition of network facilities and the level of liberalisation, with which quite a few network operators were already experienced, placed a requirement on the Government to co-ordinate the programme and to deploy policies which encouraged network operators to invest in the network.

The KII programme has been launched by a 'political push' to establish a future blueprint. The Government initiated this programme in which it promotes industry, in line with its nature as a 'developmental state' (Evans, 1996; see section 1.2.4). Although the information infrastructure is being pursued with developmental concerns in both developed and developing countries, the mechanism with which the programme is deployed follows different paths. The choice of the 'developmental state' approach cannot operate as simply as occurs in the USA. The Korean Government is not able to just limit its role to co-ordination. The telecommunications industry in Korea is in the initial stage of change from a public service to a profit-making industry. Korea Telecom satisfied the demand for basic telephone services during the rapid growth and economic development experienced from the 1960s to the 1990s, and technology development was geared to expanding the network facilities to reduce the heavy reliance on foreign equipment (see section 8.4). This task was fulfilled by Korea Telecom and the manufacturing industry with an emphasis on public service. Differing industrial maturity imposes different roles and tasks on the government. The tasks of the 'developmental state' become complicated in the transition from a public sector to a profit-making industry.

12.2.2 Global Embeddedness: Propelling Restructuring

National initiatives concerning the information infrastructure in the NICs not only address domestic commitments to develop the telecommunications network, but also respond to requirements from the world oligopoly infrastructure (Pogorel, 1994; Mansell, 1993; Melody, 1994). The globalising strategy of large carriers often includes the construction of an infrastructure across the globalising economy, as well as the expansion of their regional domination for services and networking (see section 5.2). The global trends in telecommunications currently taking place are influenced by the interests of multinational capital (Holloway, 1996; Gillispie, 1993). Globalisation in the telecommunications sector is likely to respond to this form of pressure over the use of telecommunications for the evolution of corporate organisational strategies (Mansell and Tang, 1993).

National developmental concerns in telecommunications mean establishing this sector in an advantageous position in the hierarchy of the international division of labour (Evans, 1996). The KII programme is the state's response to globalisation in the form of a national initiative for constructing a telecommunications infrastructure in order to catch up with the advanced telecommunications infrastructure which stems from US influence and which shapes the global distribution of telecommunications services. The rationale, however, is not simply meant to attract MNC investment. The power of foreign MNCs is not the dominant factor in the Korean economy; the economy has been developed in a way which has fostered domestic capital accumulation rather than merely attracted foreign MNCs investment (see section 7.3). The initiative is a positive act towards network construction, but the concerns of the Government are: (i) the development of its own network (which will eventually connect to the global network); (ii) the improvement of its industrial competence; and (iii) the support of domestic capital's foreign activities. The restructuring is being processed in a passive way in order to protect the domestic telecommunications market (see sections 9.2.1 and 9.2.2). How the improved infrastructure will work in terms of service provision and supporting economic activities for both domestic capital and foreign capital still remains in question.

The phenomenon of globalisation in telecommunications is not simply an issue of opening up the domestic market; rather, globalisation stems from new markets being formed through the adoption of new technologies. The age of the intelligent network and geodesic network (Huber, 1987; Wilson, 1990; Mansell, 1993a) coincides with networks which are now software-oriented and service-independent. The arguments for the institutional changes necessary for liberalisation then become couched in technological terms. The notion of a 'system of systems' (Noam, 1994) implies that institutional change is inevitable when the new concept of service permeates the market. The vision of system integrators is being pursued by those supercarriers who are globalising their business domain. Since the supercarriers are pursuing their identity of system integrators rather than network operators, improving national telecommunications infrastructure does not necessarily only concern development but also co-operating to create a globalising network. A clear distinction between facilities and services is suggested (Robinson, 1991) in order to accommodate both the national initiative of telecommunications infrastructure and the global expansion of supercarriers.

The restructuring of telecommunications is driven by global requirements rather than by internal need. Although the interests of capital matter at the national level, the changes in telecommunications are taking place for the purpose of protecting local markets from foreign service competition. Competition is being introduced with the logic of preparing for an open market rather than being driven by internally developed conditions in the Korean telecommunications industry. The construction of the KII, in fact, embraces this vertical global embeddedness and catalyses institutional change towards the freer environment in which the Government encourages carriers to invest in infrastructure.

12.2.3 Interaction with National Power Relations: Emerging Multiple Constituencies

Liberalisation and changes of ownership are taking place in the context of a strengthening ideology of 'globalisation' and 'reinforcing the autonomy of the private sector' (see sections 7.3.3 and 7.3.4). In the telecommunications area, the *chaebol* constantly promote the principle of competition and propagate deregulation.

Creating a freer environment in order to attract private investment for restructuring telecommunications is associated with the existing economic and social structure of the country (Constantelou, 1993). In the case of Korea, the existing *chaebol*-oriented economic structure is embedded in the process of introducing competition (see section 9.2.2), hence it is likely that this process reinforces the power of the *chaebol*. The KII programme has propelled the process by introducing radical local competition (see section 10.3.4).

The present public network, which satisfies the demand for basic telephone service in the country, is faced with a momentum to change in order to provide advanced services through a network capable of operating at high speed and with high capacity. This momentum is pushing the public network into the market-place through the introduction of competition. The debate concerning the privatisation of Korea Telecom is contested ground; privatisation is suggested as a way to survive in the competitive telecommunications market and to overcome the inefficiency of public firms (see section 9.2.4). Full privatisation of Korea Telecom, therefore, is not likely to be realised in the near future; the state considers its existence as a public body necessary for the full realisation of SOC. The circumstances can change however, if the Government chooses to locate the public network within the marketplace so as to draw capital investment into constructing the 'public information network' planned in KII. Another aspect is that the privatisation of Korea Telecom will be shaped by the relations between the interests of capital, the *chaebol* and the interests of the present political power-holders. It is largely assumed that only the *chaebol* can afford to be the dominant shareholders of public firms, in particular in the rapidly growing market of telecommunications services.

The initial plan for KII was challenged by the power of capital which has been strengthened in the process of rapid economic development. The shifting power relations determine the way sociotechnical tasks are realigned and who participates in them (see section 10.3.4). Domestic capital, which has been growing in the process of overcoming the limitations of the market and of manufacturing capabilities in the telecommunications industry, is converting its interests from selling equipment to providing services. To pursue this objective, the large conglomerates, the *chaebol*, strongly criticise public ownership, and have started to participate in the telecommunications service industry such that they have established a solid position (see section 9.2.2).

Initially, the KII programme simply adopted the B-ISDN project as a form of 'public information network', which had been being pursued by Korea Telecom as a vision for the future development of networks (see section 10.2.2). If the industry remained in the public sector, the role of government would be clear: the MIC plans it and Korea Telecom conducts it. Investment in KII construction has mostly referred to the construction of fibre optic cable to the home (FTTH) in the subscriber loop area. The subscriber loop is considered to be a non-traffic-sensitive area which gives the PTO a maintenance burden, whereas competition is mostly processed in the traffic-sensitive areas such as international and long-distance calls and mobile communications. Korea Telecom, the traditional PTO, is faced with competition, while at the same time it is expected to invest in the non-profitable subscriber loop. By inviting private sector investment, the Government have situated Korea Telecom's simple B-ISDN project as being in, and owned by, emerging multiple constituents. As the tasks of KII are realigned, we can see the evolving technological features of network construction as well as the emerging multiple constituencies. The alignments have changed, resulting in new technological alternatives such as fixed radio technology and compression technology. The notion of FTTH was reduced to FTTO and FTTC to reduce Korea Telecom's investment burden (see section 10.3.4).

With the KII programme, the governance of B-ISDN has expanded from purely technological concerns, which Korea Telecom and ETRI took part in, to a situation where multiple constituents, the Government and industrial capital, also participate in the process. The political interests of the present political leading group are intertwined with the technological and institutional realignment of KII; and the technological realignment which has expanded the simple B-ISDN project to accommodate advanced technological alternatives interacts with the institutional realignment of opening local participation which reflects the interests of the *chaebol*. The governance of this change and its propelling force, are associated with developmental concerns addressed through the government initiative.

12.3. Governance in The Shaping of Network Evolution II: CDMA

The case of the digital mobile communications system development exemplifies the Korean technology development process in the transition of telecommunications. The shifting power relations taking place in Korean society become visible in the case of CDMA development where the Government substantially loses power in the process of development. This shift in governance reflects the changing national power structure as well as the changing nature of industry. The shifting power relations are embedded in changing features of the existing R&D system, which also reflects the general challenge from the newly liberalised telecommunications market and the new international trade order. The CDMA development illustrates the transition in the governance of the whole process. The development occurred prior to the emergence of an open procurement market, and thus prior to the restriction of the role of public institutions in R&D activities under the WTO. The project started with the existing scheme within which ETRI still exerts power on behalf of the state in organising R&D activity. In the middle of the process, the nature of the developmental scheme changed from being collaborative to competitive and was caused by endogenous rather than by exogenous factors.

12.3.1 Political Embeddedness in The Notion of Indigenous Technology

Whereas the concept of SOC represents a developmental concern in KII, 'indigenous technology' is the most significant developmental concern in the CDMA case. The importance of an internally developed technology capability adapted for local use in developing countries is emphasised by Freeman and Hagedoorn (1992). In telecommunications, the developed countries have dominated the design of the facility equipment through standardising processes (Mansell and Hawkins, 1994). The CDMA development presented decision-makers in Korea with a way to escape from long-standing patterns of technological dependency. The government initiative in launching the project determined the selection of CDMA. If industrial capital had had the initiative over the development, TDMA, which has better commercial prospects, would have been selected for development. In contrast to the USA, where the direction of system development and utilisation led to a range of systems (CDMA, TDMA, AMPS), the strong government initiative in the Korean context led to the selection of the CDMA system alone.

The state's role in the standardisation process is recognised as reinforcing the domination of specific standards in the market in general (Mansell, 1993a; Mansell and Hawkins, 1993; Hawkins, 1996). The distinct factor about the CDMA development is that developmental concerns impinged on initiating the CDMA technology development, especially in the selection process. The fundamental question as Hawkins (1996) asked, is how technical and non-technical criteria are synthesised and embedded in the process of selecting and applying standards.

As we have seen in section 11.4.2, the CDMA technology was chosen to be developed with state support, and then it became the national standard. Technological superiority and prospects for export were discussed, and there was also the practical constraint that joint development of TDMA was implausible, unless Korea simply decided to purchase the system. A strong commitment to indigenous technology also accompanies the state's authority over industrial capital. We have seen that *Samsung* continuously urged the Government to change the standard. In general, governments support specific technologies, through funding and procurement policies (Hawkins, 1996). In this case, the Korean Government supported the CDMA initiative as a national standard through the existing R&D system. This kind of effort is criticised by Sherer (1994) as it results in the selection of projects with rates below the opportunity costs of capital.

The discourse in the standardisation process includes rationales such as technological superiority: for instance, CDMA has 20 times more capacity than the analogue system whereas TDMA's is only three times more. As Hawkins puts it,

> standards do not simply solve technical and commercial problems. They reflect specific epistemologies, and their discursive elements play a role in establishing the

> legitimacy of political as well as economic positions by forging links to the presumed objectivity and rationality of technical and scientific discourses (1996: 169).

When Korea chose to develop the CDMA technology, this technology was not proven in terms of its market value and its technological possibilities as compared with the TDMA technology. The issue of whether the CDMA technology was well chosen in terms of economic value and commercial prospects was strongly disputed. The debate surrounding the selection of CDMA revolves around technical discourse which also embraces the commercial and institutional interests of the participants.

In the process of CDMA development, two broad issues emerge related to indigenous technology. First, the issue of how to define indigenous technology with respect to the source of the technology is quite often disputed: what weighting should be attached to the contribution of the RF technology, which Qualcomm provided, and the switching technology, which the Korean manufacturers and ETRI already possessed. Second, the issue of whether the national technology standard of CDMA in the area of digital mobile service provision contributes to national competitiveness is often disputed.

As we have seen in sections 11.5.2 and 11.5.3, the CDMA system combines the RF technology from Qualcomm with the indigenous switching technology from ETRI and manufacturers. The capability to develop the CDMA switching system by using the indigenous switching system TDX-10 technology was found to be a significant factor in building an indigenous technology combined with the transferred technology from Qualcomm. It was often claimed that the joint development contract was not a simple import of technology; rather, it was one part of the technological development of the state-of-the-art CDMA system by using the patented technology and the origin of related technology from Qualcomm (see section 11.5.3). On the one hand, those who argue that the CDMA system is an indigenous technology refer to the significance of TDX technology. On the other hand, those who are sceptical about the amount of indigenous technology involved in the CDMA system often refer to the technological dependency upon RF technology transferred from Qualcomm, and to the large amounts of royalties which domestic manufacturers are now paying (see section 11.5.1).

How can we judge whether the newly developed CDMA system is an indigenous technology? Which is more significant, the CDMA technology or its system integration with TDX-10 technology? Furthermore, the question of which one is more significant as a proper criterion to judge whether the CDMA system is indigenous technology or not remains open.

It is difficult to judge to what extent a country can claim to have an indigenous technology. I think the judgement should be based on the purposes the players have. Even if we accept the fact that Korean manufacturers do not have the technological capability to build critical elements of the CDMA system and so pay huge amounts in royalties, we still need to consider what the indigenous technology is for. If the purposes of system development are that domestic manufacturers should maintain a stable mobile communications service and that domestic manufacturers should be fostered through stable procurement, the issue of whether Korea actually has the critical technologies for the CDMA system may not be significant.

The real issue regarding indigenous technology seems to be the latter concern with fostering domestic manufacturers. If we agree with that the reason why indigenous technology is being pursued is found in the notion of 'national competitiveness', the debate about whether the CDMA system actually contributes to reinforcing national competitiveness provides a focus for the issue. The issue now becomes more complicated, as the concept of 'indigenous technology' is becoming intertwined within social and economic contexts rather than just referring to the technology involved.

Whereas the first issue concerning indigenous technology was related to the process of development and the source of the technology, the second issue is more connected to the selection process in the early part of the development. The rationality of the single national technology standard of CDMA was criticised by the mobile communications carriers on the grounds that the standard of CDMA is a service standard rather than a technology standard per se and that this standard had not yet been proven (see section 11.5.6). The other problem surrounding the single standard of CDMA is that, because CDMA technology is patented by Qualcomm only whereas the technology formula of TDMA is open, the single standard of CDMA is likely to intensify technological dependency upon Qualcomm.

Selecting and developing a single standard in the name of indigenous technology appears to be a way to reinforce national competitiveness for decision-makers. The notion of 'efficient use of resources' has been a critical factor in the developmental history of Korean society when the Government establishes policy directions, since Korea does not have enough resources to allow for trial and error. "Unlike the USA which has an enormous market scale, our market is not large enough to accommodate the testing of various technologies" (Saw, Jeong-Uk, 1995). The single standard was arguably pursued to avoid overlapped investment. But the need to select a single standard has raised the danger of making the wrong choice, as was pointed out by the Korea Society of Young Scientists and Engineers (1996: 28), and the benefits of a single standard in this case can only be realised in a situation where CDMA has been proved to be more advanced than TDMA. In reality, nobody knows whether this is so at the moment. What matters is that assessing the standard should not be like gambling; it is certainly important to prepare for the future. The Society therefore suggests that dual standardisation is not a waste of resources; rather, it is a way to pursue the world market. They argue that the process of developing a new technology (such as TDMA) should not be considered as an overlapping investment.

The argument on both sides of the CDMA debate often became confused; one camp argued on the basis of the advanced technological solutions provided by CDMA, while the other camp referred to safety and economic concerns. For our purposes, the real issue here concerns how negotiations in the battle ground of interest groups take place. That is, the negotiations are determined by the governance mechanisms society adopts, which work to influence how the negotiations actually take place. In the case of Korea, the Government ruling in favour of the CDMA system was absolute in terms of the formal negotiation process. The perception, held by the players on both sides, was one of pursuing 'national competitiveness'. The point is to analyse how the different opinions of the players about ways to pursue national competitiveness, are resolved in the process of selecting and developing the technology. This point is discussed in greater detail in section 12.4.

12.3.2 Global Embeddedness: Challenges to The R&D system

The Korean R&D system and the ideology of indigenous technology is challenged by the newly emerging order (see section 9.3). The existing R&D system and the fragmented features of the R&D system within which the CDMA development was conducted, still have a common governance: the state's developmental concern for, and the ideology of, indigenous technology. The governance of the R&D system is changing as competition in telecommunications and the linkage between service and manufacturing replace the monopoly in telecommunications service provision and a separation between service provision and manufacturing (see sections 9.2.3 and 9.3.2). This is a global embeddedness within the CDMA case, in that the CDMA development exemplifies this transition explicitly within the developmental process.

The vertical integration of network operators and manufacturers is breaking down due to liberalisation, which requires changes in the national R&D systems in telecommunications (Noll, 1991). The national PTOs have moved away from procurement based on a closed relationship with the traditional telecommunication manufacturers (Mansell, 1993a), as a result of technological change within the network structure being more oriented to computer-based intelligence and service-independent ATM, etc.(Grupp and Schnoring, 1992). Challenges to the Korean R&D system also comes from liberalisation and the dismantling of the vertical integration of R&D activities in the traditional telecommunications industry. The difference is that, in the case of Korea, ETRI previously mediated the direct relationship between networks operators and manufacturers. The existing R&D system in the telecommunications area had been ruled by the MIC, based on the stable linkages between Korea Telecom (which plays a role in funding R&D activities and purchasing the system), ETRI (which organises R&D and transfers technology to manufacturers with superior technological capability), and the manufacturers (who participate in national strategic technology development projects with guaranteed procurement) (see section 8.4). The mediation of ETRI became inappropriate in a situation where network operators are now reluctant to fund ETRI because the beneficiaries would be competitors for services (who are now linked with the manufacturing companies) (see section 9.2.3). The new WTO system which requires public R&D institutions to conduct nothing but basic research was not yet a direct cause in the break up of the chain between the network operators and ETRI. ETRI's mediation is not likely to be effective in a situation where ETRI is not responsible for technological development on a national basis under the WTO system. This is a direct global challenge to the national R&D system which Korea faces.

In the process of the CDMA development, the chain between ETRI and the network operators was substituted by the vertical integration between the network operator and manufacturers which emerged shortly after ETRI withdrew from its practical role of mediation. The broken chain between ETRI and manufacturers has also been substituted by a vertical and direct relationship in which the carrier has power over the manufacturers, over and above the existing procurement link (see section 11.5.4). However, vertical integration, linked by procurement, was also shortly broken by competitive development and by the establishment of a multi-buyer environment. The whole R&D chain was initially broken between ETRI (a government initiative) and manufacturers, and this is more concerned as to the interaction between national power relations, an issue which is dealt with in 12.3.3.

The direct relationship, in the form of vertical integration between the carrier and the manufacturers, created competition between manufacturers as a result of heavy market pressure. The competitive development driven by this relationship became an element which at the same time worked to loosen the vertical relations between the carrier and manufacturers. In the CDMA development, the procurer still had close links with the manufacturers, but market demand forced the network operator (KMT) to impose competitive development between manufacturers. On the other hand, the emergence of the second mobile communications carrier, *Shinsegi*, broke another link in the chain as we saw when *Samsung* ceased doing its testing procedures with KMT (see section 11.5.6). Whereas

LG's independent development was a direct result of the competitive procurement policy of KMT and of LG's confidence, *Samsung*'s withdrawal from the testing procedures stems from the presence of multiple buyers.

Market pressure and the liberalising telecommunications service market is embedded in the fragmentation of the CDMA development. The chain between the carrier and the manufacturers, with the guaranteed procurement link, was broken by a form of procurement based on competition and by the presence of more than one operator. The chain between network operator and manufacturers would no longer be sustainable in an open procurement market. The development system chain connected by procurement can last as long as procurement exists, although it is not 'guaranteed'. This situation is already apparent in the competitive mobile communications market place as *Shinsegi* has admitted it is planning to purchase foreign equipment (see section 11.5.6).

In addition, the introduction of competition in telecommunications, which now allows manufacturers to participate in the area of service provision, is likely to drive the forces serving to break the whole chain (see section 9.2.3). The existing carriers argue that it is unfair to maintain the R&D chain between carriers and manufacturers in a situation where manufacturers are now participating in the area of service provision. Policy has not yet been changed to resolve this situation, but the likelihood is that the R&D chain between manufacturers and carriers will move towards one which operates on market principles. The fragmented features of the CDMA development is just the beginning of this larger change.

In summary, there are three main aspects of the changing features of the R&D system in terms of global embeddedness. First, the introduction of competition in the area of service provision and the privatisation of carriers, are possibly prompting the tension between authorised R&D systems and private carriers in a competitive environment. Second, the open procurement market policy means that the Government will no longer be able to protect domestic manufacturers through compulsory procurement by network operators. Third, extreme market pressure is producing an expectation of competitive efficiency and thereby loosening the bond of co-operation. This global embeddedness together with political embeddedness are interacting with national power relations. The underlying element which has directly broken the old R&D system is found in the fact that the private manufacturers have become powerful enough, in terms of their technological capability and funding, to be independent from the government's ruling system. The next section looks at this aspect.

12.3.3 Interaction With National Power Relations: Power Shifting Between Constituents

The transition of telecommunications and its R&D system is taking place in the context of the changing relationship between the state and capital, embodied in the policy of activating the private sector and in the ideology of national competitiveness (see section 7.3.3). Capital is now powerful enough to deploy business directly without government intervention (see sections 7.3.2 and 7.4.2). The shift of power from the state to capital has not yet been settled, but this phenomenon permeates the transition occurring in telecommunications. The power of capital is evident in its superior technology capability and funding, as compared to public institutions. The fragmentation features of the R&D system in the CDMA case reflects the interaction between global and political embeddedness and national power relations particularly concerning the chain between ETRI and manufacturers, and between ETRI and the network operator.

To begin with the link between ETRI and manufacturers, we can see the tension between them surrounding the development initiative. They even 'competed' in the process of development (see section 11.5.4). In this situation, ETRI finds its role limited to the publication of papers and patents, but not to product development (Source: Lee, Hun, 13 June 1996). We witnessed the position of *Samsung,* which was not happy with ETRI's initiative. The linkage loop of ETRI's superior technology capability over private manufacturers was not strong enough to sustain the chain in the middle of the CDMA system development. ETRI did not establish its practical authority over the manufacturers to control the project. The manufacturers, *Samsung* and LG, were rather frustrated with ETRI's control and eventually left the joint development one by one (see section 11.5.4).

The stable chain between ETRI (the government's initiative) and manufacturers (capital's initiative) linked by ETRI's technology superiority, was broken by the emergence of superior manufacturers.

The power shift also emerges between the network operator and ETRI in terms of taking the initiative over the developmental process (see section 12.3.2). The power shift between ETRI and KMT can also be interpreted as a reflection of capital's expansion, although KMT was not entirely privatised at that time. This shift was propelled by heavy market pressure. When the deadline for completing development was due, the network operator came to the forefront as KMT would purchase and install the system. This time the pre-existing procurement chain worked directly in the developmental process.

The shift of power relations, however, comes to the fore in a way which reflects the characteristics of the sector. In particular, the telecommunications manufacturing sector has grown up within the established R&D system and in a protected procurement market under government leadership represented by ETRI. The shift of power emerges ironically in the area where the state has successfully fostered the capabilities and markets, as observed by Evans (Evans, 1996). This change of governance was in fact propelled by heavy market pressure. The case of the CDMA development illustrates the crisis faced by the 'authoritarian mechanism' in a situation where the market emerges as a main force. Mobile communications is a leading edge industry and is already established as a profit-making enterprise. The CDMA case shows how the industry could respond to the interests of social forces and the existing mechanisms of Korean society.

12.4 The Authoritarian Mechanism in Transition

The embodiment of social relations in telecommunications is taking place in a network, i.e. as a specific system in which both producers and consumers are involved. In the TNS (Telecommunications Network-based Services) (Mansell 1990), there is no clear distinction between production and consumption. The participants in the telecommunications network are, in most situations, positioned as both producers and consumers. Telecommunications system developments reflect the dynamics of social development clearly, since telecommunications is now one of the critical elements of social interaction and of economic activities. Telecommunications operates in a way which intrinsically reflects its public service nature. As a result, we find state intervention in many forms. At one stage, social relations were expressed in a rather simple governance which involved state regulation and operation. Regulation has been conducted as an outcome of the nature of networks, which require systematic control and public intervention so as to create and to maintain the system, and to make sure the benefits are spread throughout society.

In the era of the intelligent network, network operators, service providers, manufacturers and end-users are participating in the process of shaping network features more explicitly than when telecommunications services were simply operated by public organisations. Expressions of capital's expanding interests are found in globalisation, liberalisation and improvements to network functions. Because telecommunications has been considered a public service, these expressions tend to be compromised with public interests. Hence, 'national competitiveness' based on state support, comes to represent capital's interests (Cho, 1996). This is a representation of state autonomy embedded in the policies towards the changes in the telecommunications industry (see section 1.2.4).

In the Korean context, the series of telecommunications policies for restructuring the telecommunications market is being deployed in response to open market pressure and to the changes in economic policies promoting liberalisation (see sections 7.3.3 and 7.3.4). In the process of introducing competition, the interests of the *chaebol* lie in participating in highly-profitable areas such as mobile communications (see section 9.2.2). The pre-existing division of labour between service and manufacturing activities is collapsing because the *chaebol* are beginning to enter the business of network and service provision (see section 9.2.3). Korea Telecom, the existing PTO in Korea, is faced with the challenges of the liberalising market and of the pressure of privatisation (see section 9.2.4). Korea Telecom Trade Union (KTTU) has taken a stand against competition and against the privatisation of Korea Telecom, arguing for the need to protect the national flagship in the telecommunications sector (see section 9.2.5).

An 'authoritarian mechanism' was proposed to understand these changes in telecommunications, reflecting Korean social relations (see section 1.2.5) of, first, a lack of institutional space for negotiation and, second, of the exclusion of labour's interests which coincides with the embeddedness of the interests of capital. To begin with the first meaning of the authoritarian mechanism, the CDMA development offers an explicit case of the embeddedness of the mechanism. An interviewee with one of the manufacturers who was involved in CDMA development revealed the following:

> Surprising, isn't it? How come a company which has no experience in switching systems, putting aside the original technology of CDMA, developed the system and even adjusted the system to CDMA and is selling it in such a short time? Personally, *I believe that it is possible because it happened in our country.* I think the government initiative is the most distinguishable factor which makes the development come true. Let me say, if AT&T spends three years on developing a switching system with $ 1000 million, for us, it would take a year with $ 10 million. Why? In foreign countries, they have strongly developed R&D systems, such as engineering groups. And it would certainly help perfect development but it takes time and money. In our case, we just develop a broad feature and then go into detail. (Kim, Chul-Kyu, 14 June 1996: emphasis added)

The term 'quick' gives us a clue as to how the authoritarian mechanism works. Is the interviewee proud of the quick development? The interviewee describes the reality of the R&D system in Korea. The absence of a systematic R&D scheme in terms of formal evaluation and persuasion helps the 'quick drive'. In the R&D process in Korea, it does not seem very important to persuade either the people involved in the market or the professionals (see section 11.5.4). The 'quick drive'[121] is possible in a situation where all decisions are made quickly. Putting aside the argument that being quick does not necessarily mean being efficient, the point is that a 'quick drive' does not accommodate space for negotiation, discussion and persuasion. Why did the development team in Korea not bother convincing professionals and players in the market? Unlike the USA, where markets exert power, it is government initiatives which make it possible in Korea to skip over the procedure of persuading markets and professionals.

---

121 'Quick drive' here implies that the development is possible with a strong initiator such as government. However, there are a number of determinants of the 'quick' syndrome in Korea in its social and cultural context. Through rapid economic development, 'quick' has been internalised in social dynamics, which is also driven by an authoritarian political culture. If I indicate collective personality in the 'quick' context, the subject becomes too complicated, but some people find, the causal nexus in the context of collective personality as well.

The selection process of CDMA is very significant in this context (see sections 11.4.2 and 12.3.1). The arguments surrounding the selection of CDMA - of technology superiority, and of safety and economic concerns - were not publicly debated. The Government limited the space for discussion to the subject of technological superiority on the basis of technological characteristics and of the pursuit of indigenous technology, even though this could possibly have been countered by other arguments (see section 11.4.1). In the process of implementation, the authoritarian mechanism did not allow space for expression of the network operator's interests. When *Shinsegi* appealed to the MIC to allow it to provide an analogue service on the basis of the risks involved in using the newly developed system, they were refused (see section 11.5.6). Even if we take into account the fact that *Shinsegi* could have pursued its own interests by taking the opportunity to provide an analogue service, it failed to do so owing to the authoritarian mechanism.

The authoritarian mechanism by which technological development is undertaken may be efficient. The problem is that the mechanism often leaves political responsibility with participants including policy-makers. Thereafter, it tends not to accommodate any space for 'failure', which is a possibility in the process of developing a new technology. In this situation, people involved in the development may attempt to prove the work successful rather than to correct the mistake (see section 11.5.4).

The authoritarian mechanism does not only work with power relations. The mechanism continuously reproduces an ideology through which the Government is able to integrate members of society. In the R&D system, the notion of 'indigenous technology' is an ideology which the Government adapted to strengthen its hold over the existing R&D system. Why do the players, especially the MIC, cling to claiming that CDMA is an indigenous technology, regardless of the possible concerns about the lack of any critical technology[122] for the system? (see sections 11.5.1, 11.5.2 and 11.5.3). Whether or not indigenous technology has been substantially built in any other sectors, the idea of indigenous technology has worked to provide authority for the MIC: in selecting the standard and manufacturers for joint development; in raising funding from state-owned

122 RF technology transferred from Qualcomm and the importing of the ASIC chip.

common carriers, Korea Telecom and Korea Mobile Telecom; and in assessing compulsory procurement by mobile communications carriers (see section 8.4.). The idea of indigenous technology is the expression of 'national competitiveness' and the current ideology of the authoritarian mechanism in which the R&D system in Korea works.

The authoritarian mechanism, however, is in crisis as the position of capital begins to subvert the authority of the state. The competitive market place in manufacturing equipment, as well as heavy market pressure, brought about competitive development by breaking the joint development scheme through which the Government controlled technological development. The Task Force, appearing as a government organisation under the MIC, was, in fact, an organisation which comprised staff from KMT. Because the authoritarian mechanism is still in transition, the organisational appearance was in the form of a nominally government organisation.

The R&D system is still run in an authoritarian way, and this causes tension within the newly emerging order. The case of the CDMA development reveals these tensions. On the one hand, the authoritarian mechanism is sustained, and on the other, the previous control exerted by the authoritarian mechanism, based on the public ownership of common carriers and on assessing compulsory procurement and regulation requirements, is undermined by market pressures. The elements of market pressure, of which the definition includes the interests of capital as well as the heavy demand for mobile communications services, is causing the mechanism to change. The interests of capital are prompted, but also exposed more clearly, by the heavy demand in the mobile communications sector.

The second meaning of the authoritarian mechanism, i.e. 'exclusion', was explicit in the ways in which the present political power-holders excluded KTTU, whereas it included the interests of capital and, further, complied with them by creating a competitive environment (see sections 9.2.2 and 9.2.5). The authoritarian mechanism still works in the areas where organisational power is weak, unlike in the case of capital. The discourse of national competitiveness comes with the notion of activating the private sector (see section 7.3.3). It has turned out that the 'private sector', as defined by the authoritarian mechanism, actually only includes the '*chaebol*', rather than embracing public interest of civil society. Hence, the Government attempts to exclude public interests by repressing the expression of labour's interests.

The mission of development has justified the authoritarian mechanism in Korea, but as the economy and the people's demands for democracy grow, the authoritarian mechanism is increasingly being questioned (see section 7.2). The fact that the state is losing power over the telecommunications sector reflects this trend, and this trend in the sector is accelerated by the changing nature of the industry globally. As in other countries, the developmental state is losing power in the sector, and the authoritarian mechanism is in crisis because of the emerging autonomy of industrial capital. The second meaning of the authoritarian mechanism, concerning the state's relationship with civil society, does not necessarily echo what is happening in the relationship with industrial capital. On the one hand, civil society loses the protection of the public sector as the industry is moving to a market-orientation, which means that civil society is more exposed to capital's action in the sector. On the other hand, civil society could take advantage of the greater negotiation space now seemingly available. Civil society could choose this different way to resolve its frustrations whereas its previous avenue under the authoritarian mechanism used to be confrontation followed by state repression.

Through an examination of the cases of both KII and CDMA, we have seen how developmental concerns are expressed through the authoritarian mechanism and how developmental concerns are replaced by capital's interests. Whether the industry has already moved to the profit-making area or not is associated with the ways projects are deployed. The development of the CDMA system, as a means of digitalising mobile communications, has been undertaken owing to the heavy pressure of rapidly-increasing demand. Both KII and CDMA share common ground where developmental concerns impinge. However, whereas the KII programme is still operated by a political push, CDMA was propelled by market demand which induced capital's interest both in mobile communications service area and in equipment manufacturing. This serves to undermine the state's control, although capital's interests are also supported by developmental concerns.

The control of government and the interests of capital are deeply enmeshed in both cases, differentiated by the weight of power depending on how deeply the industry is changing into a profit-making enterprise. In summary, the authoritarian mechanism, within which the developmental state plays a role, is in transition, and this is affected by market conditions.

12.5 Summary and Conclusion

Table 12-1 below summarises the discussion associated with the social shaping processes revealed in the case studies.

Table 12-1: Overview of Sociotechnical Elements in The Case Studies

Sociotechnical Elements	KII Sociotechnical Constituents	CDMA Sociotechnical Constituents
Political Embeddedness in Developmental Concerns	SOC* MIC's initiative* (represented by NCA)	Indigenous Technology* 1)CDMA*/ TDMA 2) TDX-10* 3) Installation*
Global Embeddedness in Transition of Telecom	NII/ Liberalisation	High Profit/Liberalisation Competitive procurement/ Multi vendor
Reflection of Power Structure in the Sector	Korea Telecom's status B-ISDN* -> adopting new technology *Chaebol*	ETRI*-> KMT: Competitive Development
Similarities and Differences	•Political Vision-developmental concern • Overwhelming political domination	•Political Achievement-developmental concern •More explicit market domination

* Constituents of Authoritarian Mechanism

In the KII programme, the MIC, the NCA, B-ISDN and the concept of SOC, represent constituents of the authoritarian mechanism whereas Korea Telecom, the adoption of newly developed technology to expand B-ISDN, and the *chaebol*, represent ingredients of change. In the CDMA development, the MIC, ETRI, indigenous technology, CDMA, and TDX-10 represent constituents of the authoritarian mechanism, whereas KMT, the manufacturers (i.e. the *chaebol*), the competitive market place, competitive development, and TDMA represent liberal ingredients. The constituents of change are associated with global embeddedness and economic incentives for industrial capital. KII and CDMA share common ground in terms of their developmental concerns. However, those developmental concerns permeate the cases in different ways, reflecting the extent of market penetration.

Globalisation affected both KII and CDMA, and the common feature of globalisation in both cases was liberalisation. The transition in the telecommunications industry caused the change in Korea Telecom's status, which undermined the state's intention to deploy the KII programme. In the CDMA development, the emergence of competitive procurement and of multiple buyers directly broke the R&D chain. Whereas the causal nexus of this broken chain resides in global influence and sectoral transformation, the national factors impinging on sectoral development are sustaining the constituents of the authoritarian mechanism. Developmental concerns work in both cases with the emphasis on 'SOC' and 'indigenous technology'. Developmental concerns in Korea are an expression of political embeddedness in economic development. Global and political embeddedness interacts with the national context, shifting the balance of power between the state and capital, and this power-relation element is directly determined by market conditions. In the KII programme, the MIC's initiative is both necessary and feasible, owing to the lack of demand for highly sophisticated services. By contrast, in the CDMA development, the power shift from ETRI to KMT, and from ETRI to the manufacturers, was clearly due to heavy market pressure. Since the case of CDMA explicitly shows the domination of market principles, it may be a pointer to the future development of KII, which is moving towards operating in an environment characterised by market forces.

The findings of this thesis illustrate the change in telecommunications as a complex of technology and social institutions which are subject to social shaping rather than it being the case that the technology is determining the changes in institutions and markets. Political and economic interests are embroiled in introducing and developing new services and networks. In particular, I have highlighted factors emerging in the transition period from public service provision to profit-making industrial provision. The technology constituting network evolution is not fixed or pre-ordained in a specific direction. Network design still takes place in a political and economic environment, in which emerging large users, existing residential and small and medium sized users, existing PTOs and public organisations all play parts in shaping the direction of network evolution.

Chapter 13: Public Interests in Network Evolution

13.1 Introduction

This thesis has explored the infrastructure of the information society: telecommunications. The changes in telecommunications have been characterised by the concepts of the 'geodesic network' (Huber, 1987; 1991), and 'from network of networks to system of systems' (Noam, 1994). These approaches often suggest that competition is an appropriate framework for the present stage of network evolution; they assume that market forces meet public interests in the end, substituting for the role of public policy. In this thesis, it has been suggested that the shift towards liberalisation is being shaped by players who also align themselves as strategic oligopolies in global telecommunications. Accordingly, the thesis does not assume that these changes will automatically meet public interests.

Analysis of the two case studies revealed how the telecommunications network is being shaped by, and embodies, the political and economic interests of players. The 'strategic model' and 'sociotechnical constituencies' guided us to see how negotiations and design considerations are shaping the characteristics of the telematics network system (see sections 1.2.2 and 1.2.6). The strategic model assumes that there will be disparities and uneven development of the terms and conditions of network access in changes in telecommunications (Mansell, 1993a). The task remaining in this thesis is to explore how public interests can be pursued in this strategic model. This chapter discusses issues associated with public interests, emerging from the analysis in Chapter 12. The discussion begins by defining public interests in the development of telecommunications; it then assesses public embeddedness in network evolution; and finally suggests a new approach towards achieving universal service.

13.2 Defining Public Interests in Telecommunications

Because telecommunications is regarded as infrastructure, industrial policy concerns are highly focused (Scherer, 1994; Collings, 1994; Harris, 1988; Noam and Kramer, 1994), and the emphasis on the role of public institutions is mostly geared at improving national competitiveness and maintaining effective competition (Miller, 1994). These policy concerns are highly supply-oriented; user participation is assumed to be achieved by state intervention. Schultz (1994), in particular, explores the aspect of social policy concerned with regulations and public institutions. The questions raised in this area are: what can be achieved by government intervention in terms of industrial competitiveness? and to what extent should government intervention be sustained? These questions are certainly significant for the role of telecommunications as infrastructure, but they overlook the issue of equity in telecommunications. Scharpf argues,

> although the diffusion of advanced information and communication technologies creates the possibility that all people will be included within their ambit and that this will bring benefits, there are those who suggest that structural privileges will continue to exclude people from productive participation in electronically mediated environments (Scharpf, 1993:155, quoted in Mansell and Silverstone, 1996: 3).

In a situation where changes in telecommunications create inclusion and exclusion boundaries (see section 12.4), public participation becomes more important to ensure that the change brings opportunities rather than threats.

Whether they are MNCs, small business users or residential users, the political power of users in designing a telecommunications network is likely to be diffuse and limited compared to that of the dominant carriers (Smith and Staple, 1994; see section 1.2.7). In the case of MNCs, the increasing users' direct power in designing telecommunications network is recognised in the process of the global expansion of MNCs (Pogorel, 1994; Mansell, 1993; Denmead et al, 1994; Mansell and Tang, 1993; Mansell, 1994). In the case of the wider public, participation in telecommunications is assumed to be mediated by state intervention in the form of regulation. Hence, defining public interests in telecommunications is more complicated.

The strategic alignment of players headed by global oligopoly is reflected in the process of liberalisation and privatisation of the telecommunications sector (see sections 5.2, 5.3 and 5.4). Regulations for deploying these policy concerns are constructed politically (Schultz, 1994), reflecting the power structure of the telecommunications industry in which global oligopolies expand their business territory in a world market. Public interests in telecommunications are often blurred with, or overshadowed by, those surrounding industrial policy. We need to differentiate the role of public institutions in realising public interests from their role in guiding industrial policy. The question of how public interests can be realised in the changes in telecommunications is also political, hence, the strategic alignments towards public interests need to be assessed.

We can start to resolve this question with the concept of 'embeddedness'. As defined before, embeddedness implies that the participation of particular social forces occurs where these are "embedded in a concrete set of social ties that binds the state to society and provides institutionalised channels for the continual negotiation and recognition of goals and policies" (Evans, 1996: 12; see section 1.2.4). The authoritarian mechanism - examined to understand the governance of case studies in chapter 12 (see sections 1.2.5 and 12.4) - was proposed in the light of the situation that the 'embeddedness' of civil society is blocked, whereas global and domestic capital's alignment are 'embedded' in the state's role in promoting development. I would like to expand this argument to the context of public participation in telecommunications policy. Establishing public interests requires the expansion of public participation through negotiation in the institutionalised channels. This is a political rather than a technical question; realising public interests depends on the relative power of civil society.

Smith and Staple (1994) recognise the unionised power of PTO employees in the process of restructuring the telecommunications market, especially with regard to privatisation (see section 1.2.7). It is a general phenomenon that PTOs are one of the largest employers in all the countries in the world. Smith and Staple (1994) suggest that employment issues need to be adequately addressed to enable a smooth process of restructuring. In particular, they are concerned with employees' power to ensure the continuation of the stable conditions of employment and benefits they have enjoyed in the public sector. I would argue that unions' activities in the PTO sector need to be addressed as a form of public participation rather than be simply considered as ensuring stable employment. The issues addressed by PTO unions are not restricted solely to employment issues as unions' activities need public support. In a situation where public users' participation is not generally very visible in the process of restructuring, unionised employees are a visible entity which plays a role in the process of restructuring telecommunications. I put unionised employees' power in the context of an anti-lobby group against competition and privatisation of the PTO in the process of the restructuring of Korean telecommunications (see section 9.2.5). Korea Telecom Trade Union actually addressed policy issues including the need for a national flagship carrier, an open market policy, and the problems of introducing competition and of the dangers of the privatisation of the PTO for universal service provision, etc. The issues raised by KTTU are not always sophisticated and they are mainly oriented to supporting the position of Korea Telecom in the liberalising market place. Setting aside judgement as to whether the issues addressed by KTTU truly represent public interests, its activities certainly serve to increase public awareness of telecommunications policy. In particular, in the situation where public participation in network design is quite restricted, the PTO unions have an important role to play in widening public participation.

In the particular social context of Korea, the authoritarian mechanism acted against the PTO unionised employees' political power by using the full repressive power of the state (see sections 9.2.5 and 12.4). There is even an argument that the Government propelled the introduction of competition in order to weaken the political power of KTTU over labour policy (Cho et al, 1996). Whether or not this is true, the strike KTTU conducted in 1995 was not a matter of employees' economic interests, but made a stand against the power and control of the authoritarian mechanism.

Ideally there should be institutions and channels through which public interests may be freely addressed and resolved by negotiation. In the recognised democratic societies, institutions and channels exist which could accommodate such public participation in restructuring telecommunications. Yet, even here, direct public participation is still limited in terms of public awareness and of civil movements concerned with telecommunications policy. Public institutions are built to support public interests, hence the role of public institutions in the process of restructuring telecommunications needs to be addressed.

In Korea, the task of establishing public interests in the sector overlaps with the task of building a democratic society. To achieve these tasks, it is essential to consider sectoral characteristics: how to pursue public interests in telecommunications in an environment changing from public ownership and control to profit-making industry, and from the state's power to industrial capital's power. The change is truly a challenge for the social agencies surrounding the sector. Thereafter it is also an opportunity for civil society which has been excluded by the authoritarian mechanism. We need to seek a practical way to ensure that the changes currently taking place in telecommunications include the establishment of institutions and channels for public participation, and for the expression of public interests, in network evolution.

13.3 Public Embeddedness in Network Design

Why should the momentum towards advanced service provision in telecommunications push public networks into the market? Why should they not remain in the public domain? The main factors pushing public networks into the market are found in the discourses of 'national competitiveness' and of the necessity for 'creating demand'(see sections 7.3.3 and 10.3.4). Ironically, the phenomenon arises from the very nature of telecommunications as infrastructure (Scherer, 1994; Harris, 1988), even from the recognition that the national network infrastructure should not be entirely market-led (Schultz, 1994; Collings, 1994).

'National competitiveness' is the prevailing discourse of Korean society in the 1990s. This discourse works as the logic underpinning liberalisation and privatisation of the industry. Telecommunications is an industry which constitutes two rather contradictory features: a public service and a profit-making industry. This dual aspect sustains the concept of telecommunications as an infrastructure, and yet this concept is being transformed with the transition of telecommunications: the infrastructure for providing public service is becoming an infrastructure for a profit-making industry. This shift from 'infrastructure/public service' to 'infrastructure/ highly profitable industry' is found in the series of phenomena.

In the construction of KII, the SOC concept coexists with a growing recognition of the telecommunications industry as a highly profitable industry, with the possibility of providing high quality services, using fibre optic cable and data compression technology. The discourses of national competitiveness substitutes for the old ideology of the cold war, and it originated from the process of expanding a US ideology of industrial competitiveness. The apparently unlimited possibilities for expansion in telecommunications markets attracts the interests of capital. The US Government has continuously deployed deregulation policies in the telecommunications market. This market used to be regulated rather strictly in the name of public interests, but now is being changed in order to encourage network operators to invest in advanced network construction.

The circumstances in Korea are not very different from those in the USA. In addition, Korea faces pressure from the expansion of global oligopoly. The discourse of national competitiveness highlights the possibilities for a flourishing telecommunications industry. Hence the state is trying to attract capital investment by opening the public network door to capital in anticipation of growing demand for high quality services beyond basic telephony (see section 10.3.4). The KII programme was established on the grounds of achieving national competitiveness and creating demand, and so it embraces the dilemma between the SOC concept and the perceived potential for a highly profitable industry in telecommunications.

How are we to resolve the conflicts between the notion of national competitiveness and of public interests in telecommunications - between efficiency and equity concerns? The common ground lies in the infrastructural aspect of telecommunications. There is a presumption that investment in network evolution will ultimately bring national competitiveness, which, thereafter, is assumed to bring well-being for the members of society. This brings us back to the dilemma between national well-being and the distribution of wealth. As Melody points out, how social services will be funded from the wealth which the national competitiveness of telecommunication companies could bring is still a mystery (Melody, 1994: 26) (see section 1.2.7).

Putting aside the general issue of the distribution of well-being, there is a need to define how national competitiveness may bring about public well-being in the telecommunications sector specifically. The issue raised here is how to sustain public interests in the shaping process surrounding network evolution. In principle, it is possible to sustain public interests in the technical domain, since the construction of the infrastructure could incorporate various functions reflecting user requirements. Indeed, the design of the telecommunications infrastructure should already be addressing the issue of who receives which services. In practice, however, questions of how to segment the network, how to establish a pricing scheme, and how to design network functions to serve particular user requirements, are being directed by those users with the most power.

It is crucial to specify what areas the state can and cannot control. Society has become so diversified that the state can no longer organise all sectors within the existing authoritarian mechanism. The KII programme is not simply forming a network evolution plan. That very plan is sociotechnical in the sense that it impinges directly on the realm of industrial and social development, the multimedia and electronics industries, and social and cultural realms more broadly (see section 10.2.1). Almost everything related to the development of the economy and society is present within the programme. All departments of the Government have incorporated elements and blueprints into the plan. The physical information super-highway network provides a clue as to the achievements Korean society wants to reach politically and economically. In consequence, the scale of the KII programme is too great for the state to control alone.

However, the blueprint cannot be realised without searching for a new way to incorporate the changing power relations between the state and capital. In addition, social organisations have become so diverse and complex that the state cannot control them efficiently. In some ways, the blueprint presented in the plan shows what should be achieved if the KII's potential is successfully realised. Conversely, it is essential to think about whether the current social and economic conditions actually need, or are even compatible with, the high performing network expected to be realised in KII. I would argue that it is over-ambitious to see KII as the means for resolving the weakness of industry and society.

It is important to acknowledge that investment, in and of itself, is not an answer to public interests. How, and in what direction, the investment is conducted is critical for both national competitiveness and public interests. We need to establish a strategy to realise public interests in the investment. Mansell suggests that a publicly controlled network infrastructure could bring wider user access to service applications in a universal networking market place (1990). We could pursue the possibility of establishing different settings of network infrastructure which mix public and private networks.

The KII programme still seeks direction in terms of network design and the articulation of user requirements. In the KII programme, the concept of SOC is only quite a vaguely articulated vision while the industry is moving to highly profitable areas. Focusing on telecommunications as network-based services, and developing infrastructure accordingly, means providing a wide range of service applications for the various user groups, including public users as well as large industrial users such as multinational firms. The network' functions describe a sociotechnical process in which social groups, including users and producers, shape the direction of the development of the infrastructure. In other words, developing an infrastructure does not necessarily lead to the availability of the infrastructure to every user group.

In sum, the perspectives of SOC and a highly profitable telecommunications industry overlap in the construction of KII. The vision of KII is subject to the concept of SOC, yet it does not define the public interest nor establish ways to protect it. The SOC in telecommunications cannot be separated from service applications and service provision. Since the KII programme sustains the concept of infrastructure, there is a need to define what the purpose of the infrastructure is to be. This study has shown that political and economic interests permeate the infrastructure of telecommunications and so ultimately determine service provision and applications. In this context, it is unlikely that public interests will penetrate the restructuring of telecommunications and service provision, either in the policy arena, or through political influence. When the immediate demands of large industrial user groups rather than public policy goals determine the direction of development, public interests are lost in a process which is led by these user groups who can afford the services offered.

There is still the question of the direction of the construction of the infrastructure. However, if the CDMA development is a pointer for the future of KII (see section 12.5), then it will be left to the market and private capital to shape the construction of the infrastructure. The future direction of network evolution is likely to depend on market principles. The KII programme will be deployed in a situation where the inclusion and exclusion of certain user groups is going to happen continuously, reflecting social relations in Korea, especially how the relationship between the state and capital and between the state and civil society evolves. It is likely that the concept of SOC will apply only to the infrastructure for private capital's interests rather than embodying public interests, and that KII will not meet its stated aim of universal telematics.

13.4 The Possibility of Universal Service

Universal service was discussed in chapter 3 as the element which has been taken for granted as a traditionally recognised way to realise public interests in telecommunications. In relation to the case studies, the issue of universal service was observed in the dispute about the privileged position of Korea Telecom in the process of introducing competition (see section 9.4). The new competitors in the telecommunications market are arguing that the concept of universal service is abused by Korea Telecom to protect its privilege, suggesting that the concept of universal service should be redefined to suit the competitive environment. The issue being raised between competitors and the policy body, however, is heavily directed to the issue of investment and infrastructure. Mansell and Silverstone acknowledge,

> The consequence of this activity is the general expectation that the diffusion of information and communication technologies will bring consumers greater choice and control over their lives. The economy is expected to benefit from growth stimulated by their wider diffusion and use. Even when system frictions and the need for structural adjustment are forecast in the face of the diffusion of these technologies, optimism continues to fuel the belief that a full-fledged equitable information society is only a matter of increased investment and continuous innovation (Mansell and Silverstone, 1996:4).

The discourse of universal service is mainly focused on the supply-side, reflecting the concerns of the PTOs, competitors and regulatory bodies in telecommunications. According to Mueller (1994) and Dordick (1990), universal service originated from the corporate interest in forming a monopoly. Theories are suggested to explain how the concept of universal service has evolved in accordance with network evolution (Mueller, 1994; Blackman, 1993; Noam, 1994a). While those theories show the evolutionary process of the construction of universal service, it seems that the actual achievement of universal service is still one where the consumer is presumed to passively absorb whatever the particular stage of network evolution needs. These theories still perceive the inevitability of trajectories of technical change and they result from "the application of analytical categories that are unable to take into account the complexity of the human choices and actions that inform and shape these trajectories through time" (Mansell and Silverstone, 1996:5).

Monopolistic provision of telecommunications has been justified through the concept of natural monopoly, which brought regulation in a situation where network provision is separated from the state's apparatus. Public monopolistic provision used to be the solution for pursuing both efficient provision and public interests simultaneously. As the industry is moving towards one which is profit-making, how the universal service provision can be sustained is being questioned (Hills, 1989; EC, 1996). Today's predominant argument is that there is no contradiction between competition and universal service (Fischer, 1994; Noam 1994a; Dordick and Fife, 1991; Kelly, 1994). The collapse of the public monopoly in telecommunications need not necessarily lead to the collapse of universal service. However, we need to acknowledge that these arguments are produced to favour competition. Our concern should not be based on considerations of the compatibility between monopoly and universal service. Just as monopoly was pursued by early telecommunications players who voiced efficiency concerns associated with the universal service goal, so competition is today being pursued by players who voice the very same efficiency concerns through their strategic alignments. The question of how efficiency concerns are associated with universal service in today's telecommunications industry seems to become a question of the compatibility between competition and universal service. As the rationale behind telecommunications service provision is changing, the rationale of universal service should be changing too. The rationale, however, is being produced by players in a way which justifies competition without changing the concept of universal service, which should be realigned in terms of goals and methods.

Acknowledging universal service as an evolving concept is used to justify players' strategic realignment in the competitive environment. This could be an opportunity for expanding the range of what is understood for universal service and how to realise it, based on the social equity aspect of universal service. The problem raised here is that the strategic alignment of the emerging global oligopoly is visible while the need for public participation to expand universal service in a socially equitable manner is not fully acknowledged. Because telecommunications network evolution is proven to result from strategic moves made by global oligopolies, sustaining or expanding universal service should not be just a defensive reaction to those actions. A strategic way to sustain universal service needs to be proposed.

It may be argued that since 'subscribers' have become 'consumers' in telecommunications (Blackman, 1995) we should attempt to replace the concept of universal service with that of 'consumer rights'. However, whilst public institutions may still protect 'consumer rights', this is limited by the extent to which market principles dominate the mechanism of consumption. I would argue that universal service is a more positive concept, around which public institutions could find ways to include more members of society so that they can benefit from telecommunications services from the outset. Whether universal service is a goal of telecommunications policy, and to what extent public institutions attempt to include the rate and quality of social consumption, are political decisions. And those political decisions can be embodied in the strategic design effort realised in network evolution.

Universal telematics is suggested in national initiatives of network construction such as the NII, and in our case, KII. Since the initiative is heavily oriented towards industrial policy, despite the concept of universal service being acknowledged as a main aim, the practical way to achieve universal service is not clear so far. There have been some suggestions to expand universal service in terms of connectivity, the features of network, openness, interoperability, accessibility and usability etc. (Hadden, 1994). Whether the KII programme actually serves the traditional goal of universal service provision, or whether it has a clear idea on how to redefine and how to realise universal service in the new context is still open to question.

Realigning universal service as the telecommunications industry changes means ensuring that the network infrastructure is designed in terms of service applications which meet public interests. While this design effort should be assessed by public institutions to expand public embeddedness with respect to technical network functions, the design process should be open to public participation through appropriate institutions and channels. Trade unions, civil movement organisations, consumer groups and so on, could participate in the process of network design and so exercise their political power. These organisations need to be aware that network design reflecting public interests can be achieved by strategic alignments. After all, these strategic alignments are needed in order to counteract the strategic alignments of the rapidly expanding global oligopoly. Without democratic participation and articulation of 'public interests' however, these organisations will only have a fragmented and small shaping impact on the process of network evolution.

Chapter 14: Conclusions

14.1 Introduction

The aim of this research was to elucidate the social shaping process in telecommunications network design and to suggest ways of enforcing public interests in the process. My research questions were reshaped and refined in the research process, reflecting the complexity of the social phenomena being investigated. Through the period of this research I often struggled between what I wanted to do and what I was able to do. The intellectual challenges started at the point of establishing a conceptual background. Because telecommunications are inherently transdisciplinary, they have been dealt with in many disciplines, expressing different depth and concerns (Snow, 1988). Many pieces of new research surrounding telecommunications have emerged, producing enormous amounts of themes and issues. I started by choosing literature reflecting my political commitment to social equity, then explored such themes and concerns surrounding telecommunications as universal service, telecommunications and development, the role of public institutions, globalisation, liberalisation and privatisation, and these were reviewed in chapters 3, 4, 5 and 6.

Chapter 7 provided some understanding of the specific social and political power structure of Korea. The political and economic bases of the *chaebol*, and its establishment in the Korean economy, helped to explain the privatisation of the public sector in Korea and its associated dominant discourses of 'globalisation', 'national competitiveness' and 'activating the private sector'. Telecommunications restructuring issues in NICs more generally (see section 5.5), and the concept of the developmental state (see section 1.2.4), were combined with this picture of Korean society to help us understand the underlying political and economic interests involved in this study.

The changes and challenges of the telecommunications industry in the 1990s were introduced in chapter 9 to show how restructuring is being conducted under open market pressures and internal demands from the private sector. The way this restructuring is taking place in Korea reflects a social mechanism which is working toward the inclusion of industrial capital and the exclusion of the public sphere (see sections 9.2.2, 9.2.5 and 13.2). In this context, the institutional rationale of protectionism both in telecommunications policy and in the national R&D system is being challenged.

Chapter 12 showed how the cases of KII and CDMA exemplify the changes and challenges of telecommunications in terms of the governance of political embeddedness, global embeddedness, and their interactions with national power relations. KII, a national initiative of network design, entails the dilemma between constructing SOC and promoting a highly profitable industry (see sections 10.2.1 and 13.3). The design process, although it did not take much time to implement, already embodies the interests of industrial capital and Korea Telecom in realigning technological tasks and policy direction (see sections 10.3.3, 10.3.4, and 12.2.3). The CDMA case showed more explicitly how the national R&D system is being fragmented, reflecting the power of industrial capital under heavy market pressure (see sections 11.5.4, 11.5.5 and 12.3.2, 12.3.3).

This study confirms that the changing order of telecommunications is subject to social shaping, reflecting the political and economic interests of players. In the specific social context of NICs, global embeddedness contrasts with developmental concerns. However, the two elements are not necessarily mutually exclusive, since the global embeddedness demonstrated in the cases still supports the interests of capital, which is also supported by its political embeddedness in developmental concerns. The developmental concern implies improving the nation's status in the hierarchy of the international division of labour. In the context of Korea, those categories of embeddedness operate within an 'authoritarian mechanism', whereas they are challenging the mechanism from the inside.

This chapter concludes the thesis, suggesting the main contributions of the thesis (14.2); its theoretical implications (14.3); its policy implications (14.4); and the avenues for further research (14.5).

14.2 Main Contributions of The Thesis: Social Shaping of Telecommunications and Its Strategic Avenue

14.2.1 Understanding The Social Shaping Process of Telecommunications in The Context of NICs

The main contribution of my research lies in explaining changes in telecommunications, within the framework of the social shaping of technology and of political economy, and in the context of the NICs. This approach broadens our perspectives on telecommunications restructuring issues in NICs, and deepens our understanding of the complexity of the matter beyond narrowly-conceived issues of technological capability and efficient policy deployment. The social shaping of technology tradition, especially the framework of 'sociotechnical constituencies', was used for analysing the process of network design together with the 'Telecommunications Network-based Services' concept with which I applied 'sociotechnical constituencies' to the context of telecommunications (see sections 1.2.1, 1.2.2 and 1.2.6).

On the basis of critiques about research concerning technological capability (Hoffman and Hobday, 1990) and positive restructuring in the NICs (Hanna, 1991; Scherer, 1994; Smith and Staple, 1994), I tried to reveal the complex reality in which the capability-building process encompassing technology and network evolution takes place. This study contributes to filling the gaps left by existing literature on telecommunications in the NICs, by showing how developmental concerns are deployed in the light of social relations. This study showed how the relationship between the developmental state and society is shaping the concrete forms of developmental concerns in network evolution. The issue of public interests need to be addressed in a distinct manner from narrowly defined 'national competitiveness'.

The global and political embeddedness and interaction with internal power relations are analytical abstractions adopted in this thesis in order to integrate the notion of sociotechnical shaping processes with the concept of 'governance'. Governance was suggested to understand the mechanism of technological development which includes inter- and intra-power relations, consensus building and the process of aligning and realigning sociotechnical tasks (see section 1.2.2). Aligning and realigning sociotechnical tasks in the technological development process, narrowly defined, is a shaping process of technology. In our case studies, the KII programme is realigned in terms of sociotechnical tasks, reflecting newly available technologies and the players' interests (see section 10.3.4). Constituencies are changed in this process: the simple B-ISDN programme came to embrace multiple constituents in terms of technological elements and players (see section 12.2.3). In the case of CDMA, power shifting between constituents is observed in terms of the organisational changes to the technological development scheme reflecting the *chaebol*'s power (see section 12.3.3), and it is reflected in the realigning of sociotechnical tasks.

14.2.2 The Political Economy Perspectives in Social Shaping Process

The social shaping process is addressed in the political economy perspective by employing macro factors such as the state and capital and by interpreting the collective interests of social agencies. This has added additional support to Mansell's contributions to telecommunications research (Mansell, 1990; 1993a;1996), by offering empirical evidence in the context of NICs on how network evolution reflects the political and economic interests of players. In addition, this study extends the political context of Mansell's contributions, by bringing macro factors and social relations into an examination of the shaping process.

Telecommunications inherently assumes a national basis as its provision is regarded as an infrastructure. Social relations, globalisation and political interests are vertically or horizontally integrated in the restructuring of telecommunications. Liberalisation is linked to the interests of domestic capital which correspond to capital's global expansion. The nature of the interests of capital in the end are identical whether or not they are global or domestic. The shift from public to private provision of telecommunications is enforced by capital's mobility (Holloway, 1996), since this industry is attractive to both global and domestic capital because of its rapid growth and technology-based characteristics (Collings, 1994) (see section 5.4). In this sense, the global embeddedness of multinational capital's interests is transformed into the embeddedness of domestic capital's interests through liberalisation. Global embeddedness is constantly interacting with the interests of domestic capital. If global influences are in conflict with national interests as a result of protectionism, this fact only implies the conflict between capital's global expansion and domestic capital's interests rather than between global capital's interests and the national interest itself. Therefore the conflict between domestic capital and multinational capital should not be seen as the main contradiction: it is, rather, a temporary contradiction which is a superficial phenomenon.

The KII programme eventually promoted competition in the telecommunications market by introducing radical competition in local telephony (see section 10.3.4). This shows that the interests of domestic capital, in the end, meet the interests of multinational capital. Although the Government sustains a policy of 'opening up the internal market first', it does not last long in terms of the collective interests of capital. In this globalising world of capital, the policy of 'opening up the internal market first' only protects the domestic market for a while. The notion of national competitiveness in deploying this policy appeals to public sentiment. However, whether it actually accommodates public interests is a different question. I cannot say that public interests could accrue from opening up the market to multinational capital but it is important to acknowledge that the notion of national competitiveness as deployed here embodies the interests of domestic capital since the development of telecommunications has only partial embeddedness (i.e. meeting the interests of capital), and excludes civil society (see section 12.4). It should not be taken for granted that public interests are met through protectionism and developmental concerns.

In the case of CDMA, global embeddedness and domestic capital's interests permeate network evolution more explicitly. Domestic capital explicitly challenged the authority of the Government in the existing R&D system (see section 11.5.4). This challenge was based on the greater capability of domestic capital (as compared with the public sector) in terms of finance and technology. Korean capital has already expanded its realm to many other countries. This domestic capital seeks to establish its firm status in technological development and in the telecommunications industry. The challenges are formulated by powerful domestic capital in manufacturing and network operations and by global embeddedness in the form of open market pressure. These challenges are bringing about a crisis in the national innovation system, which no longer stands alone in the globalising technology development system.

Political embeddedness is represented in the context of network infrastructure and indigenous technology, and this is mediated by developmental concerns. These concerns cannot be explained without looking at the nature of the state and the way in which political interests articulate economic interests. For the developmental state, economic concerns and political concerns do not seem to be separate entities. Here, the notion of development works in a way which provides an ideology supporting social integrity in the same way that the notion of indigenous technology works as an ideology to sustain the existing R&D system.

14.2.3 Political Value of The Strategic Model

Mansell's contributions in telecommunications research underpin this study in that they guide its adoption of a strategic model of research. This study confirms the political value of the 'strategic model' in unveiling how the design process is actually conducted in shaping the technologies of the telecommunications network. Because today's dominant discourses surrounding the changing order of telecommunications often refer to the 'idealist model', research using the 'strategic model' inevitably looks at how the changing order reflects players' interests and the strategic alignments they possess. With this understanding, the strategic model contributes to identifying potentially beneficial strategic alignments for groups whose interests the researcher supports.

This is the same approach that 'critical theory' argues for: we can only understand what the world is when a social theory presents us with some idea about what it ought to be, that is, with a value judgement about the ideal society (Craib, 1982: 169). As Lukacs (1971) acknowledged, the possibility of knowing social reality as a whole goes along with the extent to which capitalism expands its system. As globalisation expands, knowledge about the phenomenon expands, along with the views we choose to elucidate that phenomenon. For Lukacs, human action is linked to historical social development through the concept of *praxis*. The fragmented world which seems to control human actions can be changed, it can be seized and transformed. Consciousness and *praxis* intervene in this transformation as independent factors. This theory also acknowledges that human action is a collective and not just an individual matter, in that the social relationships produced by human action assume a dynamic of their own.

The strategic model indicates how we may look at the changes in telecommunications in the two case studies and, thereafter, what we may look at in the process of revealing the operating governance. The strategic alignments which may support public interests suggested in this thesis are, however, oriented to general politics rather than to particular instances of policy practice. I would evaluate my research as a contribution to unveiling the phenomena. The detailed technological solutions through which public participation can fulfil its strategic interests should be more fully articulated. These are also the concerns which the strategic model should further resolve.

14.3 Theoretical Implications

In this thesis, I have tried to reconcile the dichotomy identified between social agencies and social structure, the traditional sociological query in elaborating the social shaping of technology. Linking players identified in the case studies and macro and collective concepts such as the state, capital, labour and civil society have been my intellectual challenge to technology studies, in particular by using the 'sociotechnical' approach. I tried to make sense of the interests of individual social agencies in the structures within which they are placed, and of how the structures and agencies reshape each other. The case studies in this thesis illuminate the process of specific technological developments reflecting the interests of particular social agencies.

My research resides in exploring the question of the tensions between human agencies and structural transformations. The way towards resolution in this piece of research was that of exploring case studies as a process which constitutes 'sociotechnical constituencies'. The analysis is fragmented to illuminate the roles and interests of social agencies within the 'process', and these are then integrated again into the theme of 'governance'. My process-oriented research was also apparent in its design for the 'strategic' basis as discussed in section 14.2.3. The question of how the design process reflects the political and economic interests of players is no different from the question of what the interests of players are in the process-oriented research. The social shaping process per se entails those interests, and the design result represents the process.

This research expands the level of social agencies to the macro level in that those agencies are regarded as representing the collective form of social actions. This could carry the risk that I lose the detailed matter in the discussion of collective interests of an entity such as the state, capital and civil society. The investigation was, however, conducted at the concrete level, and those processes were only then integrated into the theme of governance and, again, governance is explained in a way which reflects the power structure at three levels - global, national and sectoral - gleaned from a political economy perspective.

With the political economy perspective, one could reduce the complexity of social reality to class relations, whereas case studies get into the detail. However, the social dynamics that are embedded in technology development can be more easily understood if we comprehend the structural elements, i.e. the state, capital, and civil society. "... in uniquely evolved social formations, technology has distinctive trajectories and profoundly different meanings for economic sustainability and human well-being" (Vail, 1984: 370). When we deal with certain levels of detail in the case studies, it does not necessarily plunge us into a merely micro perspective. Rather, it enables us to comprehend structure more substantially. The detail which I explored does not counter our structural comprehension, but rather complements it by showing the political and economic interests of social agencies within their social contexts.

Conversely, with a structural perspective, the detail can be investigated and interpreted to support a specific direction which was inspired by the 'strategic model'. The social relations and interests of social groups are embedded in the process of specific technological developments and network evolution programmes. This is assumed from the beginning, and the case studies were conducted to illuminate the matter. The embeddedness is revealed by this research.

My research contributes to expanding the sociotechnical approach to explore collective interests in the framework of 'sociotechnical constituencies' by adapting political economy perspectives. This framework provides an analytical tool with which I have shown how macro social constituents interplay in a complex of power that shapes the broad development of technology within a social structure that tends to reproduce the power base of the dominant social constituency. Macro social constituents became 'purposive' drivers rather than simply being regarded as background factors in technology development within the framework of 'sociotechnical constituencies'. The concept of 'governance' filled the gap between interests of social agencies and social structure, in that the abstract entities which are generated and recreated by actors' interactions in the shaping process were apparent.

Within political economy perspectives, social relations became apparent in the analysis of the technology development process through the concept of embeddedness, which shapes the design of technology. The political interests of the developmental state embodied in 'indigenous technology' and 'network infrastructure', and a particular set of social relations in Korea are interacting with the process of technology development, being found in the phenomena of 'emerging multiple constituencies' (see section 12.2.3) and 'power shifting between constituents' (see section 12.3.3). The embeddedness of a particular set of social dynamics within the development process became explicit by drawing upon the underlying complexity within 'sociotechnical constituencies'.

The strength of 'sociotechnical constituencies' is that it helps map out the incredibly complex issues surrounding technology development which encompass political, economic, social and technological viewpoints, within a more holistic framework. This framework leads us to integrate the individual disciplines into a multidisciplinary viewpoint which accommodates different layers of complex realities surrounding the development process, from individual interactions to institutional and structural factors.

However, while the framework of 'sociotechnical constituencies' provides a good first step which allows us to summarise what underlies the complexity surrounding technology development, we are still left with the complexity of technology development in using it. The framework of sociotechnical constituencies needs to be applied to detailed case studies because of its main virtue in providing a tool to understand the complexity underlying the development. And from the very strength of 'sociotechnical constituencies', the weakness of it emerges in that it produces a very complex picture which we still need to interpret and analyse. To understand the picture, we need other methodologies with which we can interpret and analyse such complexity. It seems that the framework of 'sociotechnical constituencies' works best when it is complemented by other methodologies depending on the particularity of the case studies involved.

With respect to policy development, while the interests of social agencies are apparent in the process of revealing the social shaping process, how actual policies should provide a vehicle towards a more positive future of technology development and network evolution still need to be resolved. Although I characterised the macro social constituents as 'purposive' drivers within the framework of 'sociotechnical constituencies', their interests are interpreted within their structural constraints. I discussed the public interests in designing network evolution in chapter 13, but this only reveals what the problems are rather than providing a means to their resolution. The framework I adopted contributed in such a way to allow me to understand the complex realities surrounding technology development rather than producing practical solutions. Although practical solutions are not given, the approach taken does suggest a positive future of greater public participation in telecommunications network evolution by illuminating useful starting points for policy development.

If our analyses only describe certain facts, without identifying or critiquing the ideologies and rules underpinning social phenomena, where can we find a practical role for social scientists? 'Theoretical praxis', as suggested by Habermas (1971), is precious in that analyses provide us with a critical insight into the relations of social contexts. By giving insight into the nature of specific relations in various social contexts, analyses enable us to find the space for dialectic change and to improve them - but only when the analysis has an appropriate methodology to reveal the reality.

In relation to technology studies, the critical point seems to reside in recognising the ideology of progress. Who will decide the direction of progress? It appears that the sociotechnical approach is one form of response to this question. There is no principle of progress, only the direction which members of society continue to formulate. The critical issues the sociotechnical approach should resolve are: an articulate framework which provides an appropriate instrument to look at the complex reality of the social shaping process in technology development at both micro and macro levels of analysis; a contribution that it exposes the usually concealed power relations embedded in the macro structure. My research might be regarded as an integration of two perspectives: the sociotechnical and the political economic.

Nowadays, advanced technologies have contributed to change the infrastructure of human life, acting as the force of production in industrial development. Technology studies are endowed with a role in the decision-making process over the direction of technological change and with the intention of improving human life.

14.4 Policy Implications

The practical realm in society can be divided into politics and policy. In terms of politics, sociological analyses can contribute to supporting the reproduction of the present power structure. Equally, sociological analyses might provide scientific support to political opposition groups. In terms of policy, whereas the micro approach to revealing social phenomena is criticised based on its political utility, the macro approach tends to leave practical solutions in the realm of politics, which is rather equivocal. Because the problems are to be solved on the structural level, the practical solution is oriented to the political hegemony struggle rather than towards suggesting visible policy solutions.

The embeddedness suggested in this thesis to some extent encounters the same kind of problems. The institutional channel for public participation seems heavily oriented to political matters. The authoritarian mechanism related to social relations is suggested as governance in shaping the technological development process. The authoritarian mechanism, however, resides in governance, which is created as rules and ideologies, and which is generated and recreated by interactions and negotiations by social agencies. The complex reality embraces both equity and efficiency concerns. This is a dilemma that policies should resolve to meet the needs of a country's society and economy.

Based on the findings in the process oriented research, the technological and political concerns to build public participation were suggested to fulfil the political mission of the strategic model (chapter 13). In fact, I illuminated the issues and difficulties in addressing public interests. Public embeddedness should be fulfilled in network evolution, which could possibly be oriented to public interests with design efforts by defining what purpose the network serves. The design process is the construction process which varies network functions and service applications. This is possible because today's network features heavily rely on software functions. This is also a political question of how social agencies participate in the design process.

In this section, I would like to elaborate policy concerns in which public participation is institutionally channelled, and efficient network construction is carried out. Even if the fundamental solution still resides in the political realm, it would be worth suggesting policy concerns, because governments or the general public simply cannot wait until the problem of governance is resolved. Above all, governance is created and recreated by social agencies' constant interactions. Although embeddedness is a structural matter, there are things incrementally changeable in the policy realm.

Network evolution is a form of design process. How the design of an infrastructure accommodates the social and economic needs of the country and how this process embraces public participation are the main policy concerns based on my research findings. For realising universal telematics, 'universal service' can be realigned in the network design process rather than being restricted to financial consideration. I would like to elaborate these concerns in the concept of 'locality' in Korean telecommunications.

The Korean Government should realise that it is time to tackle the subject of locality. Since economic development has been carried out through central planning, local needs have tended to be ignored, and this has caused unbalanced development in the country. In the KII programme, because of the centralised planning in improving network facilities, what local economies and local people actually need from the investment has not been seriously addressed. Centralised planning is still important in terms of initiating and co-ordinating the programme. However, since investment is aimed at improving telecommunications network facilities nation-wide, how these are used and how these are constructed are not separate concerns.

The Government introduced radical competition in local telephony to encourage private investment (see section 10.3.4). 'Super-highway carriers' are granted for providing local telephony alongside Korea Telecom and *Hanaro* Telecom, and their capacity and potential to serve the local economy and society can be enormous. Central government has limitations in assessing, top-down, how this capacity serves local areas. This is a question of how regions absorb high-quality network functions, and how these serve local economic development. The newly-emerging technologies and services do not directly ensure regional welfare. Transformation depends on how the design matches the sociotechnical requirements and realities of the region, alongside the other policy concerns.

The participation of local government in the design process seems crucial, although their capabilities have not been exercised in this delicate matter because of their relative inexperience. For example, the local carriers which facilitate the local telecommunications infrastructure in each region could co-operate with local government. The competitors (Korea Telecom, *Hanaro* Telecom, and the super-highway carriers) could connect local government facilities on a competitive basis, and build government systems with effective technological solutions integrated to the network construction. What kind of applications they need could be reflected in the speed of network construction.

Apart from local governments, local organisations such as universities, hospitals, libraries, etc. could also be directly connected to the local telephone companies. In practice, these connections could be organised by locally-situated universities. First, they have the knowledge and facilities with which they could congregate local needs. Second, they could benefit highly from the high-quality services for research and teaching functions. This could be an important turning point for them as communications capabilities offered by high-capacity and high-speed network facilities and computerised systems, could solve some of the long-standing frustrations with the centralised educational and research system. They could communicate with the facilities and people in Seoul through the super-highway network.

Indeed, the information super-highway could integrate locality into a centralised system and distribute the centralised resources to local facilities. If 'locality' is respected by the newly established competitive system, competition could also flourish in the process of winning local contracts for new facilities in a proactive manner. Local competitors could eventually profit from traffic generated by using their facilities for active communications within local organisations, between locals, and between central and local organisations.

Locality has been ignored in the process of centralised economic development: information technology and the newly developed infrastructure could resolve this disparity. Ubiquitous services and universality of access are generated by the efficient use of facilities, and this usage is not vertically created by centralised planning.

As to the R&D system, the CDMA system development seems to be the last government initiative facing the new world trade order. The issues of whether CDMA technology was the right choice or not is already out-of-date as the industrial trend is to accommodate those two technologies into one single system for the next generation of mobile system UMTS (Universal Mobile Telecommunications System) (GSM Service Monitor, 6 October 1997). Korea certainly gained a leading-edge in producing the CDMA system. It is likely that the CDMA capability of Korea will be a basis for developing the next generation of mobile communications systems. My research concerns did not lie in assessing whether the development was successfully carried out, but in revealing the complex reality and concerns surrounding the development. I have never done so previously, but I would now like to praise Korea's success in building this technology capability.

The capabilities are, however, intrinsically connected to the national innovation system. The vertical integration between the PTO and manufacturers is collapsing internally by the introduction of competition in the service market, and externally by the opening up of the procurement market. The competitive service market coexists with the competitive procurement market. In this situation, private manufacturers seek to establish their own capabilities on the basis of competition. The remaining tasks locate the role of ETRI in the newly emerging order such that it can mediate a new form of collaboration between manufacturers.

In terms of technology and finance, the private sector has proved to be capable enough to cope with technological developments on its own. These capabilities became the basis of competitive development which emerged in the process of the CDMA development. Collaboration among manufacturers could be sought in any case. However, because the collaboration was possible on the basis of ETRI's authority, in the situation where ETRI's authority was challenged by the private sector's capability, collaboration was eventually fragmented. Collaboration could now emerge from the manufacturers' own needs and the features of this new collaboration should be different from the one which sustained the existing national innovation system in Korea. A new way of collaborating among manufacturers without government initiatives should be one of challenges the manufacturers should resolve in the process of building an R&D system in the newly emerging order.

The role of ETRI should be inevitably relocated. In this process, the R&D resources accumulated in ETRI in the particular situation of Korea should not just be regarded as the undesirable residue of a centralised development system. In the situation where Korea has this precious resource anyhow, it would be worthwhile to establish ways to use ETRI's capability in the new environment. For example, although manufacturers complained that ETRI's role overwhelmed the technological development process, ETRI certainly provided

CDMA with its academic insights. These academic insights are accumulated capability. ETRI could support the development of the private sector as a resource in guiding possible innovation sources. The remaining task is to find ways to link this capability to the private sector effectively.

In the transition of telecommunications, building a new innovation system is a far more complicated matter than I have suggested here. This does not seem sufficient for this complicated matter and does not fully address the complexity of the R&D system as such. My research does not provide these insights in great depth because this was not my main research question. However, even if my suggestion is not very articulate or rich, I hope the insights I provided in the analysis of the CDMA development could provide help in the process of restructuring the R&D system, including relocating ETRI's role.

14. 5 Further Research

The remaining tasks occur in identifying further research. I have discussed how this study contributes to expanding our understanding about the social shaping process of telecommunications in the NICs and to supporting the political value of the strategic model of research. Further research mainly concerns what chapter 13 implied on the subject of the public interest based on the strategic model, and what I would like to expand on from my research.

The topic of indigenous technology concerns both what I could not properly involve and what I would like to explore more in further research. I identified this topic as an ideology of the authoritarian mechanism of the R&D system (see section 12.3.1). Economic and social issues are involved in the process of selecting technology in relation to this topic (see section 11.4.2). However, I could not answer whether this technology serves the social and economic needs of society and what should be the benchmarks for judging superior technology. Technical discourses and economic concerns are involved in these debates, and these were dealt with in revealing the process, rather than involving myself in judging it as this was not directly relevant to my research question. However, I think my research could suggest more articulate views, or, at least, could contribute to revealing the selection process in a more articulate manner if I possessed firm views on how we can judge this matter and what the significant factors are concerning this subject. For further research, how indigenous technology reflects players' perceptions and technological solutions, and what economic and social needs are integrated into indigenous technology, need to be more focused. This is also an important subject for the national R&D system.

In terms of practice, I say that my job was to reveal the phenomena and suggest what issues need to be addressed. The direction of the research was to some extent preordained by what I think the world should be like. Revealing the shaping process of technology development and network design in my research suggests a direction to serve the improvement of human life, which the strategic model inspired. What should be achieved by public participation through institutional channels and political activities needs to be defined more technically so that public participation can achieve something visible in terms of policy priorities. The strategic model has the potential to resolve this issue. The subject of network evolution is dealt with in the concept of design. What 'design' constitutes is certainly beyond mere technical concerns. However, dissolving the dichotomy between 'social' and 'technical' does not mean we should ignore the technical matters because those matters exactly convey what design efforts should be focused on, in the process of policy-making and public participation.

The issue of universal service was not directly explored because of the practical limitations of exploring this through the case studies (see section 2.6). For the topic of universal service, we need to investigate how policies and discourses are constructed in the network design process and in the outcome of technological developments which lie in the future. This includes many aspects of policy domains and practical concerns. The subject of the 'design process' involves a wide range of policy concerns which are also integrated into universal access. For example, the topic of 'interconnection' is a key factor in introducing competition. The interconnection agreements between network operators, and between network operators and service providers are not considered as purely a business matter. Rather, interconnection involves policy concerns in the design process, as it is the issue of how the networks are connected and how the network accommodates service provision.

This can be a significant subject for network design in relation to exploring how the network is formulated, how competition works and how players on the supply side see the issue of universal access.

On the subject of globalisation and its embeddedness in network design, exploration of the relationship between global carriers and national carriers should be expanded: how they connect to each other and what their eventual roles may be in the globalised telecommunications network in terms of the division of labour. We need to define the role of national carriers and suggest how they should react rather than simply suggesting and emphasising the need for national carriers' to build capabilities against global carriers, and beyond the 'national flagship carrier'. In the transition of telecommunications, a service-independent network architecture is commonly suggested. A service-independent network architecture implies that networks do not depend on specific services, as ATM technology implies. Because networks carry many kinds of services, network features are not characterised by any specific services. In this environment, it is likely that networks are integrated into oligopolistic features on both national and global levels as a result of mergers and acquisitions among the carriers. In contrast, service provision is likely to remain competitive. The role of national carriers should reflect these prospects. Global embeddedness can be explored further reflecting this phenomenon.

This research has shown how telecommunications networks are designed reflecting social relations, global influence and the political and economic interests of social agencies. Unveiling the processes shaping technology embraces a practical intention to show a space for possibilities for change and for participation. The concept of design implies the space which both politics and policy should fill. The priorities for judgement in designing technology are not preordained by a specific direction because that judgement is shaped by social agencies, which are acting from within their social location, and which are also changing it.

The case of Korea has certainly demonstrated this through the shaping processes of KII and CDMA. In particular, the shifting power relations within the respective sociotechnical constituencies are giving greater weight to market forces. In this context, the concept of universal service is being redefined towards a limited interpretation of 'pubic interests'. Any change to widen the scope of public interests will require at least two elements: (a) the establishment of effective participatory channels for the involvement of groups at present playing a marginal role, and (b) an articulation of the concept of public interests for effective policy implementation. This is of course a major challenge and it could be easily dismissed as unrealistic. My view is that this challenge cannot be abandoned in the face of difficulty if a fairer information society is ever to emerge in Korea.

APPENDICES

Appendix 1: Lists of Interviewees

The interviewees are listed in the categories of topics and in the chronological order. The interviewees are sometimes overlapped among the topics (indicated as *) and some interviewees appear twice in the same topic if they were reinterviewed.

Changes of Telecommunications Market and Universal Service

7 February 1995b: Kim, Sung-Kyu (Head, Technology Development Planning Centre for KII, Electronics and Telecommunications Research Institute)*

7 February 1995c: Kim, Seong-Youn (Supervisor, Planing Department in R&D Strategy Planning Group, Electronics and Telecommunications Research Institute) *

14 February 1995: Kim, Hyung-Man (Managing Director, Business Counter-plan Dept. Korea Telecom Trade Union), Kim, Seh-Oak (Managing Director, International Affairs Dept., Korea Telecom Trade Union)

22 February 1995a: Yim, Hong-Soon (Manager, Project Development Sector, Korea Telecom)

22 February 1995b: Shin, Byung-Chon (Director, Ad-hoc Strategy Department, Corporate Strategy Planning Group, Korea Telecom)*

28 February 1995: Cha, Jae-Young (Manager, Research & Development Dept., Engineering Strategy Planning Group, Korea Telecom)

12 June 1996a: Kim, Seong-Youn (Head, Information Infrastructure Research Centre, Information Infrastructure Planning Section, Electronics and Telecommunications Research Institute)* - reinterview

17 June 1996a: Lee, Ju-hyung (Director, Strategy Planning Dept., Korea Mobile Telecom)*

24 June 1996: Jung, Tae-Chul (Director, Strategic Planning Division, Strategic Planning Department, DACOM)

The Case of KII

12 January 1995: Cho, Yong-Kil (Ph.D. Senior Researcher, National Computerisation Agency)

16 January 1995: Yoon, Tae-Sup (Deputy Director, Network Management Division, KII Task Force; delegated from National Computerisation Agency)

17 January 1995: Soh, Young-Jin (Ph.D. Deputy Director, Government Network Planning Division, KII Task Force; delegated from National Computerisation Agency)

26 January 1995: Ha, Won-Kyu (Ph.D. Principal member of technical staff, Techno-economics Department, Electronics and Telecommunications Research Institute)

7 February 1995b: Kim, Sung-Kyu (Head, Technology Development Planning Centre for KII, Electronics and Telecommunications Research Institute)*

7 February 1995c: Kim, Seong-Youn (Supervisor, Planing Department in R&D Strategy Planning Group, Electronics and Telecommunications Research Institute)*

15 February 1995: Kim, Choon Shik (Ph.D. Director, New Business Strategy, Korea Telecom)

22 February 1995b: Shin, Byung-Chon (Director, Ad-hoc Strategy Department, Corporate Strategy Planning Group, Korea Telecom)*

24 February 1995: Seo, Kwang-Hee (Deputy Director, Public Network Planning Division, KII Task Force; delegated from Korea Telecom)

11 June 1996a: Yoon, Tae-Sup, Director (Director, Information Technology Division, IT planning Team, National Computerisation Agency) - reinterview

11 June 1996b: Cho, Yong-Kil (Ph.D. Senior Researcher, National Computerisation Agency) -reinterview

11 June 1996c: Cha, Yang-Shin (Director, Planning & Co-ordination Division, Korea Information Infrastructure Task Force: delegated from Ministry of Information and Communications)

12 June 1996a: Kim, Seong-Youn (Head, Information Infrastructure Research Centre, Information Infrastructure Planning Section, Electronics and Telecommunications Research Institute)* - reinterview

19 June 1996a: Oh, Kwang-Sok (Ph.D. Director, Government Network Management Team, Korea Information Infrastructure Project Division, National Computerisation Agency)

20 June 1996: Ahn, Seung-Choon (Ph.D. Vice President, Information Super Highway Group, Korea Telecom)

The Case of CDMA

13 January 1995: Shin, Yong-Sup (Director, Technology Development Division, Ministry of Information and Communications)

14 January 1995: Kim, Won-Sik (Director, R&D Planning Division, Ministry of Information and Communications)

27 January 1995: Choi, Chung-Yul (Manager, CDMA Development Team, Korea Mobile Telecom)

7 February 1995a: Lee, Hyuck-Jae (Ph.D. Director, Radio Technology Dept. Mobile telecommunications Division, Electronics and Telecommunications Research Institute)

7 February 1995d: Kim, Sun-Young (Ph.D. Senior member of research staff, Radio Technology Dept., Mobile telecommunications Division, Electronics and Telecommunications Research Institute)

8 February 1995a: Kim, Kwang-Ho (Head, Project Administration Section, Mobile Telecommunication Division, Electronics and Telecommunications Research Institute)

12 June 1996b: Kim, Kwang- Ho (Head, Project Administration Section, Mobile Telecom Division, Electronics and Telecommunications Research Institute) - reinterview

13 June 1996: Lee, Hun (Director, Mobile Communications Technology Department, Electronics and Telecommunications Research Institute)

14 June 1996: Kim, Chul-Kyu (Director, R&D Dept.1. Telecommunications Systems Division, *Hyundai* Electronics Industries Co., Ltd.)

15 June 1996: Hong, Soon-Ho (Technical Director, Wireless Communication 1 Team, Communication Systems R&D Centre, Information & Telecommunication Systems Business, *Samsung* Electronics Co., Ltd.)

17 June 1996a: Lee, Ju-hyung (Director, Strategy Planning Dept., Korea Mobile Telecom)*

17 June 1996b: Chang, Yoon-Sik (Manager, Digital Business Centre Planning Dept. Korea Mobile Telecom)

21 June 1996a: Saw, Jeong-Won (Team Manger, Business & Strategic Planning Team, Strategic Planning Division, *Shinsegi* Telecom, Inc.)

21 June 1996b: Saw, Dong-Jin (Manager, Business & Strategic Planning Team, Strategic Planning Division, *Shinsegi* Telecom, Inc.)

Appendix 2: Interview Questions

Changes of Telecom Market and Universal service

To Korea Telecom

- Status of Korea Telecom in the rapid change of telecommunications market

- Vision on introducing competition

- Vision on universal service in the competitive environment

To competitors

- Changes of telecommunications in terms of policy and market structure

- Position of the organisation

- Views on the reinforcing position of Korea Telecom as a national flagship operator and a service provider of universal service

- Problems and practice of universal service

- Business prospects in the future in terms of network evolution with respect to linkage between wire and wireless network

To Korea Telecom Trade Union

- Issues on introducing competition raised by KTTU

- Strategies and projects of the union in integrating labour movement and policy issues on telecommunications

The Case of KII

To MIC

- Difficulties and changes of the programme since KII was launched in 1994

- Ideas on how to induce private sector participation/ interests of private sector

- Things that should be achieved for public interests in KII

- What momentum KII brings in network evolution

To NCA

- The role of NCA

- Relationship with Korea Telecom in the process of implementing the plan

- Difficulties and changes of the programme since KII was launched in 1994

- Difficulties in construction of national information network

- Ideas on how to induce private sector participation/ interests of private sector

- Things that should be achieved for public interests in KII

- What momentum KII brings in network evolution

To Korea Telecom

- The role of Korea Telecom in KII

- Problems and changes/ merits and difficulties after B-ISDN expands to KII

- Vision on KII in Korea Telecom's position in the competitive market place

- Business prospects of Korea Telecom as a network operator integrating KII, wireless network for PCS and the existing network.

To ETRI

- What is KII and what is vision on KII

- The level of technology capability in constructing KII

- Meaning and assessment of KII from the perspectives on technology capability and economic concerns

<u>**The Case of CDMA**</u>

To MIC

- Reason to choose CDMA (policy orientation, political situation, technological needs in the stage)

- Factors concerned in selecting process of CDMA and building the organisation (to develop technology and to select participants)

- The process of generating CDMA development

To ETRI

- The role of interviewee

- The role of ETRI

- Co-operation and conflicts with manufacturers and Qualcomm

- Evaluation on technology capability of each manufacturer

- Technological factors associated with the existing national technology capability and with key technology from Qualcomm

- Evaluation on selecting CDMA in terms of circumstance and technological characteristics

To the manufacturers

- The role of interviewee in the development process

- The role and contribution of the organisation

- Technological capability of the manufacturer in participating in the development

- Merits and short-comings of the collaborating development

- Problems and difficulties in the developmental process

- Technological focus each manufacturers concentrated on in terms of competition between manufacturers, especially, after commercial model was developed

- Market prospects in the future and at present

To network operators

- Interests and requirement in the process of development/ procurement/ installation of the system

- Evaluation on the system

- Technological and economic criteria for selecting system among *Samsung/ Hyundai/* LG

- Evaluation on the process of development in terms of role of ETRI and participation of manufacturers

BIBLIOGRAPHY

Albery, B., What level of dialtone penetration constitutes 'universal service'?, *Telecommunications* Policy, 19 (5), 1995, 365-380.

Amsden, A., *Asia's Next Giant: South Korea and Late Industrialisation* (Oxford University Press, New York, 1989).

Antonelli, C., The Economics Theory of Information Networks, Antonelli, C. (ed.), *The Economics of Information Networks* (Elsevier Science Publishers, Amsterdam, 1992).

Antonelli, C., The dynamics of technological interrelatedness: the case of information and communications technologies, Foray, D. and Freeman, C. (ed.), *Technology and the Wealth of Nations: The Dynamics of Constructed Advantage* (Pinter Publishers, London, 1993), 194-207.

Archambault, J. A., *Incremental or Radical change in Semiconductors Manufacturing?: Some Evidences from South Korea,* SPRU Paper (SPRU, University of Sussex, 1992).

Bell, D., *The Coming of Post-Industrial Society: A Venture in Social Forecasting* (New York, Basic Books, 1973).

Bernt, P., Kruse, H. and Lansbergen, D., Impact Of Alternative Technologies On Universal Service And Competition In The Local Loop, *Telematics and Informatics*, 10 (4), 1993, 359-377.

Bijker, W., Do Not Despair: There Is Life Constructivism, *Science, Technology,& Human Values*, 18 (1), Winter 1993, 113-138.

Bijker, W. and Law, J.(eds.), *Shaping Technology/Building Society* (The MIT Press, Cambridge, Massachusetts, 1992).

Blackman, C., Universal service: obligation or opportunity?, *Telecommunications Policy*, 19 (3), 1995, 171-176.

Bloor, D., *Knowledge and Social Imagery* (Routledge & Kegan Paul, London, Henley and Boston, 1976).

Bogdan, R. and Taylor, S. J., *Introduction to Qualitative Research Methods* (Wiley, New York, 1975).

Bonefeld, W. and Holloway, J., *Post-Fordism & Social Form: A Marxist Debate on the Post-Fordist State* (Macmillan, London, 1991).

Borrows, J., Bernt, P. and Lawton, R., *Universal Service in the United States: Dimension of the Debate* (Wissenchaftliches Institut fur Kommunikationsdienste, 1994).

Braverman, H., *Labour and Monopoly Capital: The Degradation of Work in the Twentieth Century* (Monthly Review Press, London, 1974).

Brian, F., *Social Theory and Political Practice* (Allen & Unwin, London, 1975).

Bruce, R., Cunard, J. and Kneifel, B., Exploring New Ways to Attract Capital for Privatisation, Wellenius, B. and Stern, P. (ed.), *Implementing Reforms in the Telecommunications Sector* (The World Bank, Washington, D.C., 1994).

Bulmer, M., *Sociological Research Methods: An Introduction* (Macmillan, London, 1982).

Cable, V. and Distler, C., *Global Superhighways: The Future of International Telecommunications Policy* (The Royal Institute of International Affairs, London, 1995).

Callon, M., Laredo, P. and Rabeharisoa, V., The Management and Evaluation of Technological Programme and the Dynamics of Techno-Economic Networks: The Case of AFME [Agence Francaise pour la Maitrise de l'Energie], *Research Policy*, Vol.21, 1992, 215-236.

Cho, H. Y., 'State Autonomy' and Class in the Economic Development of South Korea -Social Conditions of the South Korean Industrialisation, Amended for the paper presented at a Section of the Annual Meeting of the American Sociological Association, New York, August 16-20, 1996.

Cho, S., Choi, B. and Choi, S., Restructuring the Korean telecommunications market: Evolution and challenges ahead, *Telecommunications Policy*, 20 (5), 1996, 357-373.

Choi, B. I., Korean Telecom Market Reform, *Transnational Data and Communications Report*, May/ June 1991, 27-32.

Choi, C. J., Political Cleavage, Koo, I. (ed.), *The State and Society in Contemporary Korea* (Cornell University Press, Ithca, 1993).

Choi, C, J., *The Theory of Korean Democracy* (HanGilSa, Seoul, 1993). (Korean)

Choi, Y. I., The efficient promotion proposal for Korean digital mobile telecommunications technology development, *Cellular*, (Korean)

Chowdary, T. H., Telecommunications restructuring in developing countries, *Telecommunications Policy* , 16 (7), 1992, 591-602.

Clark, T., Socialised Industry: Social Ownership or Shareholding Democracy?, Clegg, S. (ed.), *Organisation Theory and Class Analysis: New Approaches and New Issues* (Walter de Gruyter & Co, Berlin, 1990).

Clegg, S. and Dunkerley, D., *Organisation, Class and Control* (Routledge & Kegan Paul, London, Henley and Boston, 1980).

Comer, E. (ed.), *The Global Political Economy of Communications: Hegemony, Telecommunications and the Information Economy* (Macmillan, London, 1994).

Collings, J., Managing the Process of Sector Reform, Wellenius, B. and Stern, P. (eds.), *Implementing Reforms in the Telecommunications Sector* (The World Bank, Washington, D.C., 1994).

Constantelou, N., Liberalising telecommunications markets: Political externalities in the Greek case, *Telecommunications Policy*, 17 (6), August 1993, 431-445.

Cornford, J. and Gillespie, A., Cable Systems And The Geography Of UK Telecommunications, *CURDS policy research papers No. 21* (CURDs, University of Newcastle, 1992).

Cowhey, P. F., The Political Economy of Telecommunications Reform in Developing Countries, Wellenius, B. J. and Stern P. A. (ed.), *Implementing Reforms in the Telecommunications Sector* (The World Bank, Washington, D.C., 1994), 545-566.

Craib, I., *Modern Social Theory: From Parsons To Habermas* (Wheatsheaf Books, Brighton, 1984).

David, P. and Steinmueller, E., Standards, Trade and Competition in the Emerging Global Information Infrastructure Environment, Proceedings of A CEPR/GEI Workshop, *Competition, Regulation, Standards and Trade Policy for Information and Telecommunication Services*, 2/3 May 1996.

Denmead, M., Aknai, P. and Ablett, S., *Global Networks: Corporate Telecoms Requirements* (Analysis, Cambridge, 1994).

Dordick, H. S., The Origins Of Universal Service: History As A Determinant Of Telecommunications Policy, *Telecommunications Policy*, 14 (3), June 1990, 223- 231.

Dordick, H. S. and Fife, M. D., Universal service in post divestiture USA, *Telecommunications Policy*, 15 (2), April 1991, 119-128.

Downs, S., Asynchronous Transfer Mode and public broadband networks: The policy opportunities, *Telecommunications Policy*, 18 (2), March 1994, 114-136.

Evans, P., Dietrich, R. and Skocpol, T. (eds.), *Bringing the State Back In* (Cambridge University Press, Cambridge, 1985).

Evans, P., *Embedded Autonomy* (Princeton University Press, New Jersey, 1996).

Fischer, P., USO and Competition in Switzerland, Gray, N. (ed.), *USO in a Competitive Telecoms Environment* (Analysis, London, 1994), 131-135.

Foray, D. and Freeman, C. (eds.), *Technology and the Wealth of Nations: The Dynamics of Constructed Advantage* (Pinter Publishers, London, 1993).

Fransman, M., AT&T, BT, and NTT: Vision, Strategy, Corporate competence, Path-dependence, and the Role of R&D, *JETS Working paper No. 8* (JETS, University of Edinburgh, 1992).

Freeman, C. and Perez, E., Structural crises of adjustment, business cycles and investment behaviour, Dosi, G., Freeman, C., Nelson, R., Silverberg, G. and Soete, L. (eds.), *Technical Change and Economic Theory* (Pinter, London, 1998).

Freeman, C. and Hagedoorn, J., *Globalisation of Technology*, FAST, Global Perspective 2010 - Tasks for Science and Technology, Vol.3, June 1992.

Fujioka, M., Yagi, H. and Ikeda, Y., Universal Service Creation and Provision Environment for Intelligent Network, *IEEE Communications Magazine*, 29 (1), January 1991, 44-51.

Gabel, D., Pricing voice telephony services: Who is subsidising whom?, *Telecommunications Policy*, 19 (6), 1995, 453-464.

Garnham, N. and Mansell, R., *Universal service and Rate restructuring in Telecommunications*, OECD/ICCP No.3 (OECD, Paris, 1991).

Garnham, N., Whatever happened to the information society?, Mansell, R. (ed.), *Management of Information and Communication Technologies* (Aslib, London, 1994), 42-51.

Garbe, D., Social compatibility of telecommunication technologies: Results of the Citizen Report on ISDN, *Telecommunications Policy*, Vol.16, November 1992, 646-656.

Giddens, A., *New Rules of Sociological Method*, second edition (Polity Press, Cambridge, 1993)

Gillespie, A. and Robins, K., Non-Universal Service?: Political Economy And Communication Geography, Brochitie, J. et al. (eds.), *Cities Of The 21st Century - New Technologies And Spatial Systems* (Harlow, London, 1991).

Gillespie, A., Telematics and Its Implications for Industrial and Spatial Organisation, *Regional Development Dialogue*, 14 (2), Summer 1993, 138-153.

Gillis, M. et al, Social Goals And Basic Needs: Telephone Access, Miller, J. (ed.), *Telecommunications And Equity* (Elsevier Science publishers, Amsterdam, 1986).

Graham, S., Conford, J. and Marvin, S., The socio-economic benefits of a universal telephone network: A demand-side view of universal service, *Telecommunications Policy,* 20 (1), 1996, 3-10.

Grandy, O. H., Inequality: You Don't Even Notice It After A While, Miller, J. (ed.), *Telecommunications And Equity* (Elsevier Science publishers, Amsterdam, 1986).

Gray, N. (ed.), *USO in a Competitive Telecoms Environment* (Analysis, London, 1994).

Grupp, H. and Schnoring, T., Research and development in telecommunications: National systems under pressure, *Telecommunications Policy*, 16 (1), Jan./Feb. 1992, 46-66.

Habermas, J., *Theorie und Praxis* (Suhkampf Verlag, Frankfurt/M., 1971).

Hadden, S., Extending Universal Service Through The NII, NTIA, *20/20 Vision: The Development of National Information Infrastructure*, NTIA Special Publication 94-28, March 1994, 47-54.

Hanna, N., *The Information Technology Revolution and Economic Development,* No. 120, World Bank Discussion Papers (The World Bank, Washington, D.C., 1991).

Harris, R., *California Telecommunications Policy for the Twenty-First Century*, A Report to the California Economic Development Corporation, "Vision: California 2010" Project, 30 June 1988.

Harris, R., Telecommunications Services as a Strategic Industry: Implications for U.S. Public Policy, 15 June 1990, *memeo* to be published in *Competition and the Regulation of Industries*, 1990.

Harris, R., Divestiture And Regulatory Policies: Implications For Research, Development And Innovation In The US Telecommunications Industry, *Telecommunications policy,* 14 (2), 1990a, 105-124.

Harrison, R., *Study of the International Competitiveness of the UK Telecommunications Infrastructure*, Prepared for The Department of Trade and Industry (PA Consulting Group, London, 1994)

Hassink, R., *South Korea: Economic miracle by policy miracle?*, Maastricht Economic Research Institute on innovation and Technology, report 2/94-023.

Hawkins, R., Standards for Communication Technologies: Negotiation Institutional Biases in Network Design, Mansell, R. and Silverstone, R. (eds.), *Communication by design: The politics of Information and communication Technologies* (Oxford University Press, Oxford, 1996).

Hills, J., Universal Service: Liberalisation And Privatisation Of Telecommunications, *Telecommunications Policy,* 13 (2), June 1989, 365-371.

Hobday, M., *Semiconductor technology and the newly Industrialising Countries: The Diffusion of ASICs (Application Specific Integrated Circuits)*, DRS Discussion Paper No.64, Second Draft: for submission to World Development (SPRU, University of Sussex, 1989).

Hobday, M., The *needs and possibilities for co-operation between selected advanced developing countries and the community in the field of science and technology: Country report on the republic of Korea* (SPRU, Brighton, 1991).

Hobday, M., The World Semiconductor Industry: Industrial organisation, Technological Change and Prospect for Developing Countries, paper prepared for the United Nations Development Programme in Brazil, FECAMP project : "Technological Development of Industry and the Constitution of a National System of Innovation in Brazil" (SPRU, University of Sussex, 1990).

Hoffman, K. and Hobday, M., US Telecommunications Policy and the Third World: the primacy of development concerns over pressures for regulatory reform, *Information Technology for Development,* 5 (3), 1990, 327-360.

Holloway, J., Global Capital and the National State, Bonefeld, W. and Holloway, J. (eds.), *Global Capital, National State and the Politics of Money* (Macmillan, London, 1996).

Huber, R., *Geodesic Network I, II* (Department of Justice, Washington, D.C., 1987; 1991).

Hudson, H., Towards a National Telecommunications and Information Policy: A Development-Based Vision, NTIA, *20/20 Vision: The Development of National Information Infrastructure*, NTIA Special Publication 94-28, March 1994, 79-92.

Hudson, H., Universal service in the Information Age, *Telecommunication Policy*, 18 (8), 1994a, 658-667.

Hughes, T., *Networks of Power* (The Johns Hopkins University Press, Baltimore and London, 1983).

Hughes, T., The Seamless Web: Technology, Science, Etcetera, Etcetera, *Social Studies of Science*, Vol.16, 1986, 281-292.

Hughes, T., The Evolution of Large Technological Systems, Bijker, W., Hughes, T. and Pinch, T. (eds.), *The Social Construction of Technological Systems: New Directions in Sociology and History of Technology* (The MIT Press, Cambridge, 1987), 51-82.

Jessop, B., *State Theory: Putting Capitalist States in Their Place* (The Pennsylvania State University Press, Pennsylvania, 1990),

Jones, M., The Promise of the NII: Universal Service in the Key, NTIA, *20/20 Vision: The Development of National Information Infrastructure*, NTIA Special Publication 94-28, March 1994, 99-108.

Kang, M. J., Competition in Local Telephone Service and Growing CAPs in the US Telecommunications Market, KISDI, *Journal of Information and Communications Policy,* February 1993. (Korean)

Kelly, T., Universal Service - an Instrument for Regulatory Capture?, Gray, N. (ed.), *USO in a Competitive Telecoms Environment* (Analysis, London, 1994), 33-44.

Kim, E. J., Telecommunications development in the Republic of Korea, *Telecommunications Policy*, Vol.17, March 1993, 118-138.

Kim, Ho-Ki, Dismantlement of the authoritarian political power and transition to democracy (1987-1992), *Change of Korean Society* (Hanul, Seoul, 1994), 26-59. (Korean)

Kim, Hyung-Ki, The idiosyncrasy of reproduction of Korean capitalism and prospect, *Change of Korean Society* (Hanul, Seoul, 1994), 123-169. (Korean)

Kim, J. K., A search for understanding globalisation, *Space and Society*, No.4, 1994, 10-19. (Korean)

Kim, J. K., Globalisation Paradigm and Korea, *Economy and Society*, No.22, Summer 1994, 28-45. (Korean)

Kim, J. C. and Roh, T. S., Current policy issues in the Korean telecommunications industry, *Telecommunications Policy*, Vol. 17, Sep./ Oct. 1993, 481-492.

Kim, K. H., CDMA mode digital mobile telecommunications system development, *memeo*, February 1995. (Korean)

Kraemer, K., Payoffs From Investment in Information Technology: Lessons from the Asia-Pacific Region, paper to be presented at the South East Asia Regional Computing Conference (SEARCC), Hong Kong, 5-8 October 1993.

Kurisaki, Y., Globalisation or regionalisation?: An observation of current PTO activities, *Telecommunications Policy*, 17 (9), December 1993, 699-706.

Latour, B., Mauguin, P and Teil, G., A Note on Socio-Technical Graphs, *Social Studies of Science*, Vol.22, 1992, 33-57.

Law, J., The Anatomy of a Socio-Technical Struggle: The Design of the TSR2, Elliot, B. (ed.), *Technology and Social Process* (Edinburgh University Press, Edinburgh, 1988), 44-69.

Law, J. and Callon, M., The Life and Death of an Aircraft: A Network Analysis of Technical Change, Bijker, W. and Law, J. (eds.), *Shaping Technology/Building Society: Studies in Sociotechnical Change* (MIT Press, Cambridge, 1992), 21-52.

Lee, M. H., *Universal Service Policy : Theory and Application*, PhD thesis in Department of Management and Policy, Korea Advanced Institute of Science and Technology, 1992. (Korean)

Lee, S. K., Technology development of digital mobile telecommunications, ETRI, *Current Technology Weekly*, 1993. (Korean)

Lee, Y. W., 'Opening' and Capitalism in Korea, *Economy and Society*, No.22, Summer 1994, 103-137. (Korean)

Lim, H. B., *Market, State, Democracy* (NANAM, Seoul, 1994). (Korean)

Lukacs, G., *History and Class Consciousness* (Merlin, London, 1971).

MacKenzie, D., Marx and Machine, *Technology and Culture*, 25 (3), July 1984, 473-502.

MacKenzie, D., 'Micro' Versus 'Macro' Sociology of Science And Technology, *Edinburgh PICT Working Paper* No.2 (RCSS, The University of Edinburgh, 1988).

MacKenzie, D., Economic and Sociological Explanation of Technical Change, *Edinburgh PICT Working Paper* No.27 (RCSS, The University of Edinburgh, 1990).

Mansell, R., The Role Of Information And Telecommunication Technologies In Regional Development, *OECD STI Review*, No.3, April 1988, 135-173.

Mansell, R., *Telecommunication Network-based Services: Policy Implications*, OECD/ICCP Report No.18 (OECD, Paris, 1989).

Mansell, R., Rethinking the telecommunication infrastructure: the new "black box", *Research Policy*, 19 (6), December 1990, 501-515.

Mansell, R. and Jenkins, M., Networks and Policy: interfaces, theories and research, *Communications & Strategies*, No.5, 1992, 31-50.

Mansell, R. and Jenkins, M., Networks, industrial restructuring and policy: The Singapore example, *Technovation* , 12 (6), 1992 (a), 397-406.

Mansell, R., *A Networked Economy: Unmasking The 'Globalisation' Thesis,* Paper presented at the PICT National Conference, Kenilworth, 19-21 May 1993 (SPRU, University of Sussex, 1993).

Mansell, R. and Tang, P., Telecommunication, Multinational enterprises and Globalisation, *SPRU CICT Report Series, No.8* (SPRU, University of Sussex, 1993).

Mansell, R., *the new telecommunications: a political economy of network evolution* (Sage, London, 1993a).

Mansell, R., From telephony to telematics services: equity, efficiency and innovation, *Brunel PICT policy research paper No.24* (ESRC PICT, Brunel University, 1993b).

Mansell, R., Multinational organisations and international private networks: opportunities and constraints, Steinfield, C., Bauer J. M. and Caby, L. (eds.), *Telecommunications in Transition: Policies and Technologies in the European Communities* (Sage, London, 1994).

Mansell, R., Negotiating the management of ICTs- emerging patterns of control, Mansell, R. (ed.), *Management of Information and Communication Technologies* (Aslib, London, 1994a)

Mansell, R. (ed.), *Management of Information and Communication Technologies* (Aslib, London, 1994b).

Mansell, R. and Hawkins, R., *International Workshop on Standards, Innovation, Competitiveness and Policy*, SPRU Workshop Briefing Paper (SPRU, University of Sussex, 1994).

Mansell, R., Communication by design?, Mansell, R. and Silverstone, R. (ed.), *Communication by design: The Politics of Information and Communication Technologies* (Oxford University Press, Oxford, 1996).

Mansell, R., Network Governance: Designing New Regimes, Mansell, R. and Silverstone, R. (ed.), *Communication by design: The Politics of Information and Communication Technologies* (Oxford University Press, Oxford, 1996a).

Mansell, R. and Silverstone, R., The Politics of Information and Communication Technologies, Mansell, R. and Silverstone, R. (ed.), *Communication by design: The politics of Information and communication Technologies* (Oxford University Press, Oxford, 1996).

McNamara, J., Government regulation and innovation in local telephone services, *Technovation*, 12 (6), 1992, 387-396.

Melody, W., The Information Society: Implication for Economic Institutions and Market Theory, Comer, E. (ed.), *The Global Political Economy of Communications: Hegemony, Telecommunications and the Information Economy* (Macmillan, London, 1994).

Miles, I., The Information Society: Competing Perspective on the Social and Economic Implications of Information and Communication Technologies, Dutton, W.H. (ed.), *Information and Communication Technologies: Visions and Realities* (Oxford University Press, Oxford, 1996).

Miller, N., Regulation: Reconciling Policy Objectives, Wellenius, B. and Stern, P. (ed.), *Implementing Reforms in the Telecommunications Sector* (The World Bank, Washington, D.C., 1994).

Milne, C., Universal Telephone Service In The UK, *Telecommunications Policy*, 14 (5), 1990, 365-371.

Molina A. H., *The Social Basis of the Microelectronics Revolution* (Edinburgh University Press, Edinburgh, 1989).

Molina A. H., *Analysing European Technology Policy: Networks, Communities, System and Sociotechnical Constituencies* (RCSS, The University of Edinburgh, 1993).

Molina, A. H., The Nature of "Failure" in a Technological Initiative: The Case of The Europrocessor, 1995, *memeo.*

Molina, A.H. and Kinder, T., From Purposiveness to Sustainability in the Formation of Multimedia Clusters: Governance and Constituency Building in Scotland, Paper written for the International Workshop on Regional Economic Restructuring and Multimedia, Stuttgart, 8-11 October 1997, *memeo.*

Mueller, M., Universal service in telephone history: A reconstruction, *Telecommunications Policy*, 17 (5), July 1993, 352-369.

Noam, Eli M., Network Tipping and the Tragedy of the Common Network: a Theory for the Formation and Breakdown of Public Telecommunications Systems, IDATE, *Communications & Strategies,* Special edition, 1992, 49-86.

Noam, Eli M., Beyond liberalisation: From the network of networks to the system of systems, *Telecommunications Policy*, 18 (4), May/June 1994, 286-294.

Noam, Eli, M., Beyond liberalisation III: Reforming universal service, *Telecommunications Policy*, 18 (9), 1994a, 687-704.

Noam, E. and Kramer, R., Telecommunications Strategies in the Developed World: A Hundred Flowers Blooming or Old Wine in New Bottles?, Steinfiend, C., Bauer, J. and Caby, L. (eds.), *Telecommunications in Transition* (Sage, London, 1994).

Noble, D., Social choice in machine design : the case of automatically controlled machine tools, MacKenzie, D. and Wajcman, J. (eds.), *The Social Shaping of Technology* (Open University Press, Milton Keynes, 1985).

Noll, M., The future of AT&T Bell Labs and telecommunications research, *Telecommunications Policy*, 15 (2), April 1991, 101-105.

Noll, M., A study of long distance rates: Divestiture revisited, *Telecommunications Policy*, 18 (5), July 1994, 355-362.

Patton, M. Q., *How to Use Qualitative methods in Evaluation* (Sage, London, 1987).

Pinch, T. and Bijker, W., Science, Relativism and the New Sociology of Technology: Reply to Russell, *Social Studies of Science*, Vol.16, 1986, 347-360.

Pinch, T. and Bijker, W., The Social Construction of Facts and Artefacts: Or How the Sociology of Science and the Sociology of Technology Might Benefit Each Other, Pinch, T., Bijker, W. and Hughes, T. P. (eds.), *The Social Construction of Technological Systems* (The MIT Press, Cambridge, Massachusetts, 1987), 17-50.

Pogorel, G. (ed.), *Global Telecommunications Strategies and Technological Changes* (Elsevier, Amsterdam, 1994).

Radio Journal, The comparison of digital mobile telecommunications mode and technology development, May 1993. (Korean)

Robinson, P., The international dimension of telecommunications policy issues, *Telecommunications Policy*, 15 (2), April 1991, 95-100.

Russell, S., The Social Construction of Artefacts: A Responsive to Pinch and Bijker, *Social Studies of Science*, Vol.16, 1986, 331-346.

Saw, J. U., *CDMA VS GSM* (Seoul, 1995). (Korean)

Saw and Lim, Globalisation and Democracy, *Globalisation and the Korean Society,* (Seoul, 1994). (Korean)

Schement, J., Beyond universal service: Characteristics of Americans without telephones, 1980-1993, *Telecommunications Policy*, 19 (6), 1995, 477-485.

Scherer, P., Telecommunications Reform in Developing Countries: Importance and Strategy in the Context of Structural Change, Wellenius, B. and Stern, P. (ed.), *Implementing Reforms in the Telecommunications Sector* (The World Bank, Washington, D.C., 1994).

Schultx, R., Regulation and Telecommunications Reform: Exploring the Alternatives, Wellenius, B. and Stern, P. (eds.), *Implementing Reforms in the Telecommunications Sector* (The World Bank, Washington, D.C., 1994).

Skocpol, T., *States and Social Revolutions: A Comparative Analysis of France, Russia, and China* (Cambridge University Press, Cambridge, 1979).

Smith, P. and Staple, G., *Telecommunications Sector Reform in Asia: Toward a New Pragmatism*, World Bank Discussion Papers (The World Bank, Washington, D.C., March 1994).

Snow, M., Telecommunications literature: A critical review of the economic, technological and public policy issues, *Telecommunications Policy*, 12 (2), June 1988, 153-183.

Sohn, Ho-Chul, *Korean Politics in Transition* (Creative and Critique Sa, Seoul, 1993). (Korean)

Song, Ho-Keun, *Open Market, Closed Politics* (Nanam, Seoul, 1994). (Korean)

Spaeth, S., A Comparative Study of the Regulatory Treatment of Enhanced Services in the United States and the European Community, *Northwestern Journal of International Law & Business*, 1 (2), 1989, 415-443.

Treheux, M., Privatisation and competition versus public service, *Telecommunications Policy,* Vol.16, December 1992, 756-758.

Tyler, M., Letwin, W. and Roe, C., Universal service and innovation in telecommunications services: Fostering linked goals through regulatory policy, *Telecommunications Policy*, 19 (1), 1995, 3-20.

Vail, D., How to tell the forest from the trees, *Technology in Society*, Vol.11, 1989, 347-376.

Wallerstein, I., The Rise and Future Demise of the Capitalist World System, *Comparative Studies in Society and History*, 16 (4), September 1974, 387-415.

Walker, W. and Sharp, M., Thatcherism and Technical Advance: Reform without Progress?, *Political Quarterly*, 62 (2), 1991, 262-272.

Weber, M., *The Methodology of the Social Sciences* (The Free Press, New York, 1949).

Webster, A., *Science, Technology and Society* (Macmillan, London, 1992).

Williams, R. and Russell, S., Opening The Black Box and Closing It Behind You: On Microsociology in the Social Analysis of Technology, *Edinburgh PICT Working Paper* No.3 (RCSS, The University of Edinburgh, 1988).

Williams, R. and Edge, D., Social Shaping Reviewed: Research Concepts and Finding in the UK, *Edinburgh PICT Working Paper* No.41 (RCSS, The University of Edinburgh, 1992).

Wilson, R. and Teske, P., Telecommunications and Economic Development: The State and Local Role, *Economic Development Quarterly*, 4 (2), May 1990, 158-174.

Winner, L., Social Constructivism: Opening the Black Box and Finding it Empty, *Science as Culture*, 3 (16), 1993, 427-452.

Yadong, W., Towards An Era Of Global Village: The dynamics of world telecommunications and its implications for the future of nation state, *Research Policy Studies Discussion Paper No.191* (Research Policy Institute, University of Lund, 1992).

POLICY REPORTS, DOCUMENTS AND STATISTICS

The Bank of Korea, *Economic Statistics Yearbook*, 1993. (Korean)

Cho, S., *Restructuring Telecommunications Market And Future Policy Tasks*, KISDI, June 1996. (Korean)

The Consortium for Evaluating Management of Korea Telecom, *Final report on management of Korea Telecom*, December 1994. (Korean)

The Contract document of 'Joint Development Agreement' with Qualcomm in CDMA, 30 April 1992.

The Contract document with domestic firms on CDMA, 1992. (Korean)

Electronics Daily Co., *Information and communications industry Outlook*, 1993, 1994, 1995. (Korean)

ETRI, The plan for co-operated development for digital mobile telecommunications system, 20 August 1992 (Korean).

ETRI, The plan for development of digital mobile telecommunications system, May 1992a. (Korean)

ETRI, Progressing report for mobile telecommunications research and development, April 1992b. (Korean)

ETRI, Material for firm proposal of Digital Mobile Telecommunication System Joint Development, 16 September 1992c. (Korean)

ETRI, The condition of subscribing mobile telecommunications and the prospecting number of subscription, internal data in ETRI, 1992d. (Korean)

ETRI, The First evaluation paper on digital cellular system, July 1992e. (Korean)

ETRI, *Digital mobile telecommunications system development*, 1993. (Korean)

ETRI, Prepared material for parliament question time, 1994. (Korean)

ETRI, Lists of R&D, 1994a. (Korean)

ETRI, *Proceedings for Direction of Technology Development for KII*, The Workshop II, Many 1996. (Korean)

European Commission, *Background Report: Progress in the Telecommunications Sector*, B/07/95, July 1995.

European Commission, *Universal Service for Telecommunications in the Perspective of a Fully Liberalised Environment: An Essential Element of the Information Society*, EC DG XIII, Telecommunications, Information Market and Exploitation of Research, Brussels, 12 March 1996.

FCC, *Recommendation Decision in the Matter of Federal -State Joint Board on Universal Service*, CC Docket No. 96-45, 8 March 1996.

The First Law Offices of Korea, The lawful comments for Joint Development of TDX-10 mobile telecommunications switching system, 22 July 1992. (Korean)

The Information Industry Task Force, *The National Information Infrastructure- Agenda for Action* , 1993.

ITU, The Changing *Role of Government in an Era of Deregulation, Universal Service and Innovation: Fostering Linked Goals Through Regulatory Policy*, ITU Briefing Report for the Regulatory Colloquium (ITU, Geneva, 1994).

ITU, World Telecommunications Development report 1996/1997 (ITU, Geneva, 1997).

The KII Task Force, *The Master plan for the Construction of a Super-Highway Information Infrastructure*, November 1994. (Korean)

KISDI, *Statistics for Information and Communications*, 1993, 1994, 1995, 1996. (Korean)

KISDI, *Improvement of Procurement Institution in Korea Telecom I, II* , 1991, 1992. (Korean)

KISDI, *Trends of Information and Communications Industry*, Reference Material Series 96-02, 1996. (Korean)

KISDI, *A study on policy direction for expanding competition in telecommunications and introduction of new services*, May, 1996a. (Korean)

Korea Mobile Telecom, Prepared material for parliament question, September 1995. (Korean)

Korea Mobile Telecom, Comments on opening telecommunications service to telecommunications equipment manufacturers, Business Strategy Team, internal document, 13 January, 1996. (Korean)

Korea Telecom, *A study on the Digitalisation Strategy for Subscriber Loop Network*, 1988. (Korean)

Korea Telecom, *Strategy for commercialisation of ISDN*, September 1990. (Korean)

Korea Telecom, *The Plan for ISDN Pilot Service in 1992* , 1991. (Korean)

Korea Telecom, *Towards TOP (Telecommunication Oriented Paradise) in the 21st century*, 1994. (Korean)

Korea Social Science Society, *Construction of Super highway network and Strategy of national Development*, October 1994. (Korean)

Korea Society of Young Scientists and Engineers, *Problems and Tasks of Single Standardisation for CDMA*, Proceedings for the second FORUM, 9 March 1996. (Korean)

KTTU, "This is KTTU's views on open market policy and privatisation," advertisement during the struggle in 1995, Dong-A Daily, 31 May 1995. (Korean)

Lee, H. J., PCS Planning in Korea, seminar presentation paper, ETRI, 1994, *memeo.*

Mercury, *Universal Telecommunications Services,* Regulatory Consultation: Mercury's Response, March 1996.

Ministry of Communications, *MOC Annual Report 1991.* (Korean)

Ministry of Communications, *A Basic plan for the construction of an Information Super-Highway Network*, August 1993. (Korean)

Ministry of Communications, Answer for the question raised by Cheong, Kyun-Whan, MP, October 1993. (Korean)

Ministry of Communications, *The Master plan for the Construction of an Information Super-Highway Network for the 21st century,* March 1994. (Korean)

Ministry of Information and Communications, *Basic Policy Direction for Reinforcing Competitiveness of Telecommunications Business*, July 1995. (Korean)

Ministry of Information and Communications, Press release on proposal of the first offer lists for NGBT, December 1995. (Korean)

Ministry of Information and Communications, *Annual Report on Informatisation*, 1996. (Korean)

Ministry of Information and Communications, *Direction of Information and Communications Policies*, March 1997. (Korean)

NTIA (National Telecommunications and Information Administration), U.S. Department of Commerce, *NTIA Telecom 2000: Charting the Courses for a New Country* (NTIA, Washington, D.C., 1988).

NTIA, *20/20 Vision: The Development of National Information Infrastructure*, NTIA Special Publication 94-28 (NTIA, Washington, D.C., March 1994.

OECD, Ad Hoc Group of Experts on Global Information Infrastructure - Global Information Society (GII-GIS), DSTI/ICCP (96)3/PART 4, 16 February 1996.

Office of Statistics, *Major Statistics of the Korean Economy*, 1993. (Korean)

Oftel, *Fair Trading in Mobile Service Provision*, Consultative Document, May 1996.

Parliament Discussion Papers in the Committee for Transportation and Communications, 1993, 1994. (Korean)

Proposed comments from individual firms which wished to participate or became participants (*Daewoo* Communications co., *Lucky GoldStar* Information & Communications, Ltd., *Samsung* Electronics co., *Dongyang* Electronics and Communications Co.) to MOC and ETRI; and responses from MOC and ETRI, September - December 1992. (Korean)

Proceedings of Workshop on "Korea - U.S. Information Super-highway International Workshop", 13 October 1994. (Korean)

Representatives Committee of Public Sector Trade Union, *Conference Proceedings on 'Tasks for Public Sector Trade Union Movement'*, 14 January 1995. (Korean)

Technology Policy Working Group of the Government's Information Infrastructure, Task Force Committee on Applications and Technology and National Institute of Standards and Technology, *R&D for the NII: Technical Challenges*, The National Information Infrastructure: Agenda for Action, conference proceedings, 28 February & 1 March 1994.

NEWSPAPERS

Business Week, Seoul's Telecom Tug-of-war, 28 March 1994.

Business week, Telecom's New Age, 8 April 1996,

Chung-ang Economy News, 7 April 1994

Communications Week International, 25 November 1996.

Electronics News, 21 March 1994 (Korean)

Electronics News, 25 February 1994 (Korean)

Electronics News, 10 August 1994 (Korean)

Electronics News, 18 October 1995 (Korean)

Electronics News, 21 October 1995 (Korean)

Electronics News, 17, July 1997 (Korean)

Financial Times, High Hopes, 19 May 1994.

Financial Times, 'Demand on grand scale', 9 May 1995

Chung-ang Economy News, 7 April 1994 (Korean)

Guardian, 16 April 1997.

Geil Economy News, 29 November 1994 (Korean)

Geil Economy News, 17 December 1994 (Korean)

GSM Service Monitor, 6 October 1997

Hangiure, 12 December 1995 (Korean)

Korea Economy News, 14 March 1994 (Korean).

Korea Economy News, 10 March 1994 (Korean)

Korea Times, 5 March 1994

Korea Radio News, 28 March 1994 (Korean).

Seoul Economy News, 14 February 1994 (Korean)

Seoul Economy News, 7 March 1994 (Korean)

Seoul Economy News, 18 October 1994 (Korean)